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no. 423

Bulletin 423 May, 1939

The Soil Characteristics of Connecticut Land Types

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CONTENTS

Field Identification of Soil Characteristics 5

Factors Contributing to Differences in Connecticut Soils 12

Connecticut Soils Compared with Those of Other Regions 16

General Topographic Features 18

Soil Classification 19

A Key to the Soil Types of Connecticut 21

Interrelation of Soil Series 39

Land Types 42

Crop Adaptations 60

The Land Type Maps 63

FOREWORD

The present publication is designed to supersede Part I of Bulletin 320, "The Soils of Connecticut", which is now out of print. In the eight years since that bulletin was issued, a large amount of field work has added to our knowledge of the areal distribution of Connecticut soils. An excellent set of airplane photographs became available in 1934. These have provided facilities for more rapid and accurate delineation of soils as components of land types. Federal funds during the summer of 1935 contributed to the preparation of land type and land use maps of the State in a moderate degree of detail. Continued investigations of the chemical and physical factors of soil fertility of various soil types under prevailing agricultural uses have greatly expanded our knowledge of the limitations and potentialities of Connecticut soils. The development of rapid methods of chemical soil testing has provided for a wider application of such information. Forest soil studies have given a more complete picture of the chief features of soil profile development under natural conditions.

The Soil Characteristics of Connecticut Land Types

M. F. Morgan

The soils of Connecticut present an exceedingly diverse pattern in their local occurrence. It is doubtful if it will ever be practicable to prepare a soil map in sufficient detail to show all the significant soil variations that occur on individual fields. During the summer of 1936 a field party from the U. S. Soil Conservation Service prepared a map of the Scantic River watershed, showing natural soil types, soil erosion features, slope and land use. The detail was as great as could be effectively shown on a scale of four inches per mile. However, other workers of the Soil Conservation Service, now engaged in the development of soil erosion control programs on farms in this area, have found it necessary to map each field in greater detail. This experience confirms our belief that the soil characteristics of the individual farm cannot be adequately expressed by the conventional type of soil map, and can only be evaluated through the careful study of each field by the farmer and his advisers.

It is the purpose of this bulletin to supply information concerning various features of soil and related land characteristics that are involved in the agricultural utilization and fertility maintenance of Connecticut fields.

FIELD IDENTIFICATION OF SOIL CHARACTERISTICS

Many features of the soil in relation to the agricultural scene may be recognized through a careful examination of the field, both of its surface features and of the underlying soil to the depth of bedrock or to unconsolidated material that has not been affected by weathering processes. Material in this section describes such characteristics as are capable of ready identification in the field.

In order that these may be discussed more intelligently, definitions of certain terms not commonly or consistently used by the farmer are introduced.

Surface soil: The upper portion of a soil in which the mineral soil is mixed with a certain amount of organic matter, and is thus darker in color than the lower layers of soil.

Subsoil: The soil layer underlying the surface soil, and extending to a depth where there is a noticeable difference in character of the material.

Substratum: The material underlying the subsoil, and usually extending practically unchanged to bedrock formations.

Soil horizon: In a scientific study of soils as they occur in the field, the various layers of the soil are designated as "horizons". These horizons are more or less distinct, and are of great significance in showing the conditions under which the soil is developed.

In the regions of the world where the downward movement of water in the soil is practically continuous, such as is the case in all the eastern half of the United States, the soils tend to form two important horizons. The "A" horizon, the one nearest the surface and immediately below the leaf mold, if such exists, is a zone from which soluble material and the very finest soil particles designated as "colloids" tend to move downward. In all cultivated soils and in some virgin soils, at least the upper portion and sometimes all of this horizon contains enough organic matter to be darker than the lower layers of the soil. Thus there may be both "A_1" and "A_2" horizons, the former containing more organic matter, but both being "A" horizons in the sense described above.

The "B" horizon, occupying a position just beneath the "A" horizons, shows evidence that at least some of the material that has moved down from the "A" horizon has tended to accumulate in this zone. There may be differences in this general horizon, such as in color and clay content, to justify separation into B_1, B_2, etc., horizons.

Below the "B" horizon lies the rock material from which the soil is formed. In Connecticut, except where solid bedrock lies within two or three feet of the surface, this material is usually a mixture of loose stones or gravel, sand, silt and clay in varying proportions, laid down as glacial deposits or as sediments from running water. Such material is designated as the "C" horizon, although not soil in the strictest sense.

Soil color: Soils show many variations in color, and these are frequently valuable aids in distinguishing between different soils. Thirty standard soil color names have been selected for use in describing different color variations to be recognized in this State. In order that scientific workers in other states may properly interpret these names, these have been analyzed by means of the Munsell color disc method. The results are presented in Table 1.

The color terms in the table conform as nearly as possible to customary use in this locality. However, they should be considered from a relative, or qualifying, standpoint rather than as an exact terminology. Soil colors are modified by the nature of the weathered rock material, the conditions of soil profile development, the organic content and the moisture content of the soil. Reddish colored rocks in some parts of the State tend to give a characteristic color to soils from which they are formed. Certain schistose rocks high in iron content contribute an unusually reddish yellow color to some subsoils. The leaching of iron from the upper soil horizons to lower depths increases the grayness of the surface soil and gives intensified yellowish brown subsoils. Impeded underdrainage or poor surface drainage results in mottled color patterns in the subsoils and substrata, usually evidenced by streaks of rusty yellow-brown and olive-gray, tending toward a bluish gray at greater depth. Organic matter contributes to the darker color of surface soils, although the organic matter in Connecticut soils is rarely of the dead black hue so characteristically developed in the prairie soils of the Middle West. Moist soils are darker and more vivid in color than dry soils, and the degree of darkening is to some extent a function of the relative amount of organic matter for soils of similar texture.

Organic matter and humus: Plant and animal material enter the soil from the following sources: leaves, bark, twigs and other forest debris;

Table I. Analysis of Connecticut Soil Colors.

	White (Neutral 9)	Yellow (Yellow 8/8)	Red (Red 4/9)	Black (Neutral 1)
Light gray	45	4	0	51
Gray	36	13	0	51
Cream	34	36	0	28
Yellowish gray	16	35	0	49
Yellow	4	30	8	58
Grayish yellow-brown	14	23	0	63
Yellowish brown	6	26	8	60
Yellowish brown with slight reddish cast	6	21	11	62
Medium brown	11	16	2	71
Medium brown with slight yellowish cast	7	23	4	66
Medium brown with slight reddish cast	9	15	10	66
Dark brown	6	15	2	77
Light grayish brown	19	20	0	61
Grayish brown	12	13	0	75
Dark grayish brown	10	10	0	80
Very dark grayish brown	9	6	0	85
Black	9	1	0	90
Reddish gray	32	21	15	32
Reddish yellow	11	21	19	49
Light reddish brown	14	17	15	54
Reddish brown	14	15	13	58
Dark reddish brown	10	11	9	70
Brownish red	13	13	21	53
Olive-gray	28	11	0	61
Dark olive-gray	20	9	0	71
Bluish olive	20	7	0	73
Yellowish olive	22	18	0	70
Olive-drab	20	15	0	65
Drab	26	17	0	57
Dark olive-drab	16	11	0	72

dead grass, roots, stems and other crop residues; the bodies of earth worms and insects; the dead cells of bacteria, fungi and other micro-organisms; applications of animal manures, straw, tobacco stems and stalks, and fertilizers of organic substances such as cottonseed meal, castor pomace or fish scraps. This material in the soil is attacked by bacteria and fungi, thus gradually decomposing into more or less stable organic compounds of complex nature. All organic substances, in any stage of decomposition, are included in the general term "organic matter", as applied to soils. The well decomposed material, which has lost its original physical and chemical form, usually is called humus. In a cultivated soil the greater portion of the organic matter is in a humus condition, and is mixed with more or less mineral soil. Well-drained soils contain from 1 to 10 percent of organic matter in the surface layer, while swamp accumulations, known as peat, may be almost pure organic matter.

Organic matter in soils performs many important functions. It makes a heavy clay soil easier to till, and increases the retentiveness of a very sandy soil for moisture. It increases the ability of a soil to absorb heat. Aside from these physical effects, organic matter is the food and energy supply for bacteria and fungi, and through their activities plant food contained in the organic matter is made available for crop growth. The carbon dioxide set

free in the decay of the organic matter greatly increases the solvent action of the soil water on the mineral matter in the soil, thus increasing its availability.

Soil texture: The texture is determined by the sizes of the soil grains which compose the soil. From this standpoint, the coarse material, larger in diameter than two millimeters (about 0.08 inch), is not included in the calculation. The names applied to the various sizes of soil particles, as used by the United States Bureau of Soils, are as follows:

Table 2. The Names and Ranges in Size of Soil Particles

Separate	Diameter in mms.
Very coarse sand	2.0 — 1.0
Coarse sand	1.0 — 0.5
Medium sand	0.5 — 0.25
Fine sand	0.25 — 0.10
Very fine sand	0.10 — 0.05
Total sands	2.0 — 0.05
Silt	0.05 — 0.002
Clay	0.002 — and smaller size

Soils contain varying proportions of particles of all the different sizes. Few contain more than 90 percent of total sands, while even the heaviest clays seldom exceed 60 percent clay.

For convenience in designating soils with different relative proportions of sand, silt and clay, textural class names are used. The following classes occur in this State in areas of appreciable size:

Coarse sand
Less than 15 percent silt and clay.
35 percent or more coarse and very coarse sand.

Sand
Less than 15 percent silt and clay.
35 percent or more very coarse and coarse sand.

Loamy sand
15 to 20 percent silt and clay.
35 percent or more very coarse, coarse and medium sand.

Loamy fine sand
15 to 20 percent silt and clay.
35 percent or more very fine and fine sand.

Sandy loam
20 to 50 percent silt and clay.
25 percent or more very coarse, coarse and medium sand.

Fine sandy loam
20 to 50 percent silt and clay.
25 percent or more very coarse, coarse and medium sand.

Very fine sandy loam
20 to 50 percent silt and clay.
35 percent or more very fine sand.

Loam
Less than 20 percent clay.
30 to 50 percent silt.
30 to 50 percent sand.

Silt loam
Less than 20 percent clay.
More than 50 percent silt.
Less than 50 percent sand.

Clay loam
20 to 30 percent clay.

Clay
30 percent or more clay.

The field recognition of these textural classes is usually possible by eye and hand examination. The following features are characteristic:

Coarse sand: Composed chiefly of large sand grains, similar to "building sand". When the soil is rubbed between thumb and forefinger, the feel is characteristically quite rough and the grains do not adhere to each other, irrespective of moisture content.

Sand: Composed chiefly of sand grains of moderate size, similar to "moulding sand". When the soil is rubbed between thumb and forefinger, the feel is moderately rough, and the grains adhere to each other to a slight degree when very wet.

Loamy sand: Composed largely of sand grains of moderate size, with a slight admixture of finer material. When the soil is rubbed between thumb and forefinger, the feel is definitely "gritty", and the grains adhere to each other only slightly when the soil is moderately moist.

Loamy fine sand: Composed largely of sand particles of small size, yet still readily seen with the eye, with a slight admixture of finer material. No tendency to form crumbs. When the soil is rubbed between thumb and forefinger, the feel is soft, but the grains adhere to each other only slightly when the soil is moderately moist.

Sandy loam: Composed of particles of all sizes, with a definite predominance of recognizable sand grains of considerable size. Forms soft crumbs if stirred when moist and these do not harden appreciably upon drying. When the soil is rubbed between thumb and forefinger, the feel is somewhat gritty. The particles may be readily pressed together into a firm mass when moderately moist.

Fine sandy loam: Composed of particles of all sizes, with a definite predominance of moderate sand grains. Forms soft crumbs if stirred when wet and these harden only slightly upon drying. When the soil is rubbed between thumb and forefinger, the feel is mellow and only slightly gritty. The particles may be readily pressed together into a firm mass when moderately moist.

Very fine sandy loam: Containing practically no coarse sand, composed of a mixture of very fine sand with a considerable amount of finer material. Forms soft, mellow crumbs if stirred when moist, and these harden only slightly upon drying. When the soil is rubbed between thumb and forefinger, the feel is fairly smooth, with grittiness barely perceptible and no rough particles in evidence. The particles may be readily pressed together into a soft mass when moderately moist.

Loam: Composed of a well-distributed mixture of particles of all sizes, with no single grade in definite predominance. Forms firm crumbs and soft clods if stirred when wet and these harden considerably upon drying. Clods thus formed are readily broken up by foot pressure. When the soil is rubbed between thumb and forefinger, the feel is moderately smooth; the soil tends to resist a shearing pressure, leaving an irregularly jagged surface after being pushed under the thumb, when in moderately moist condition. Except when quite dry, the particles stick together readily, and a firm mass may be easily shaped with the fingers. There is no definite tendency for the soil to stick to the fingers unless it is exceptionally wet.

Silt loam: Composed of particles of all sizes, with a predominance of grains of flour-like dimensions. Sand grains not recognizable as such except in scattered occurrence. Forms firm clods if stirred when wet, and these become moderately hard upon drying so as to require considerable foot pressure to crush them. When the soil is rubbed between thumb and forefinger, the feel is quite smooth and not noticeably sticky even when rather wet. The grooves and ridges of the characteristic fingerprint are readily impressed upon the soil mass. Except when quite dry, the particles cling together, and a firm mass may be readily shaped with the fingers. There is a moderate tendency for the soil to stick to the fingers, except when rather dry.

Clay loam: Composed of particles of all sizes, although the soil characteristics are largely determined by the clay portions. Forms markedly coherent "tough" clods if stirred when wet and these dry to a hardness, greatly resisting crushing force. When the soil is rubbed between thumb and forefinger, the feel is characteristically greasy or sticky. A roughness due to scattered sand particles is barely detectable. The soil may be modeled into any shape except when very dry. The moist soil sticks to the fingers quite tenaciously.

Clay: The properties of soils of this class are entirely determined by their high content of clay particles. The characteristics described for "clay loam" are all in evidence to a more marked degree. A crude test is to bite a small quantity of the soil between the teeth. The clay loam exhibits some grittiness, while the clay does not.

Colloids: The extremely fine particles in the soil are called colloids. Due to their large surface in proportion to their weight, they exhibit many important properties not possessed by larger soil grains. They are able to absorb not only moisture but also many important chemical constituents important to plant growth, for gradual liberation to the soil solution. The colloids also act as a cement between the larger particles, and may form a complete coating over the sand and silt grains. They thus cause them to cluster or granulate, a desirable tendency within reasonable limits. However, when the colloids are chiefly inorganic, or clay-like in nature, large

proportions may tend to make the soil sticky and intractible when wet, and hard or cloddy when dry. Organic colloidal material serves to protect the soil against such effects. Soils low in colloids are not retentive of moisture and plant nutrients and are lacking in body. A moderate amount of colloids in proportion to the amount of sand and silt is most desirable.

Common Rocks that Contribute Material for Soil Formations in Connecticut:

Granite: A grayish-colored, hard, massive rock containing recognizable crystals of quartz, feldspar and mica, as well as other accessory minerals.

Syenite: Light gray or pinkish gray, hard, massive, composed chiefly of feldspar with smaller amounts of mica and little or no quartz.

Diorite: Dark gray or very dark gray, hard, massive, heavy for its bulk, composed of feldspar, black mica (biotite), and hornblende with little or no quartz.

Gneiss: A grayish-colored, hard, massive crystalline rock, showing evidences of having been changed through former intense heat and pressure (metamorphism). Shows distinct banded arrangement of the crystals, the bands frequently being highly distorted. Gneiss may be a granite-gneiss, syenite-gneiss or diorite-gneiss, similar in mineral composition to these respective rocks.

Schist: Differs from gneiss in having closely paralleled layers, along which the rock tends to split. Flakes of some of the minerals, such as mica, chlorite or hornblende, are arranged in thin layers or "folia". Schists are designated by the mineral responsible for their foliation as mica-schist, chlorite-schist or hornblende-schist.

Trap: A dark gray, dark brown or nearly black, very hard and flinty rock occurring in characteristic columnar cliffs in many parts of the central region of Connecticut, such as West Peak in Meriden and East Rock, New Haven.

Phyllite: A dark-colored, slaty type of rock, with no noticeable mineral formation, but possessed of a glossy lustre due to minute flakes of mica. It breaks readily into thin plates.

Sandstone: A rock formed from the cementation and solidification of strata of sand and fine gravel, deposited at some remote geologic age. The most common examples in Connecticut are the reddish-colored sandstones of the Connecticut Valley formed in the Triassic Age.

Shale: Also a sedimentary rock, formed in the same fashion as sandstone but of very fine silt and clay material. The rock is thus fine-grained, splitting into thin plates, and has a dull luster.

Limestone: A sedimentary rock, formed from the deposition of limy substance on the bottom of prehistoric lakes, bays, or ocean floor, and later cemented by the carbonate of lime into a rock. The distinctive feature of limestone is the fact that it effervesces freely when hydrochloric acid comes into contact with it. Limestone that becomes crystalline due to metamorphic action is called marble.

FACTORS CONTRIBUTING TO DIFFERENCES IN CONNECTICUT SOILS

A proper understanding of soils as they occur in the field involves a consideration of some of the factors responsible for soil development. These will be briefly discussed in the following paragraphs.

The Character of the Rocks

The geologic past of southern New England has been such as to give us a wide variety of rocks, and the difference in their character has in many cases brought about a marked effect on the soil from which these rocks have been derived.

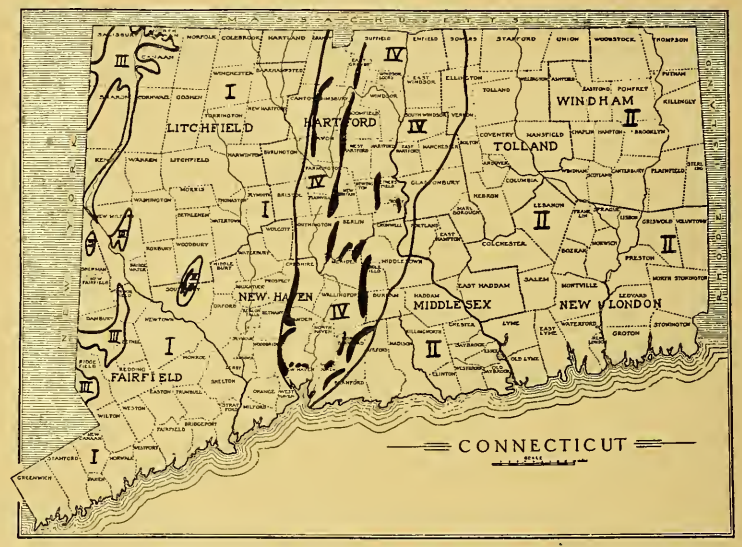


FIGURE 1. Chief physiographic and geologic regions of Connecticut. I. Western Highland of schists and gneiss rocks; II. Eastern Highland of gneiss and schist rocks; III. Western Valleys of limestone rock; IV. Central Lowland of triassic sandstone and shale rocks; black areas—"trap rock" ridges within Central Lowland.

The greater part of Connecticut, with the exception of the central portion included in Areas I and II in Figure 1, represents a complex assortment of crystalline rocks. These vary from massive gray and pinkish granites and granite gneisses through a wide range of composition, color and structure to fissile schists which sometimes approach the character of sandstones. In fact they may have been sandstone ages ago, before some titanic disturbance of the earth's crust destroyed the fossil evidences of the true origin of the rocks.

Near the northwestern corner of the State, in a narrow strip along the upper Housatonic Valley and in the vicinity of Danbury (Area III in Figure 1), marble or limestone rock (the Stockbridge limestone) is found. This relic of submarine calcareous deposits was laid down in a far distant past when the highest form of life was the trilobite, a very strange cousin of the

crabs and lobsters that now frequent our shores. With the exception of a few small and scattered localities in Area IV where thin seams of limestone are found, particularly near Northford, no other calcareous rocks are found in the State. The general absence of limestone rock has contributed largely to the acidity that is characteristic of most of our soils.

Central Connecticut and a small area in the Pomperaug Valley (Area IV) have had an entirely different history. Millions of years after the Stockbridge limestone was formed, when evolution had proceeded as far as the gigantic reptile forms of the Triassic Age, certain changes in the earth's surface brought this region under water and deposition of sandstone material on the bottom of this body of water began to take place. Climatic conditions and the chemical nature of the water was such as to give a reddish color to the cementing material that developed about these sand grains. The latter were usually composed of small and but slightly weathered fragments of the crystalline rocks of the rugged uplands of eastern and western Connecticut, from which they were washed by torrential streams.

During the same period great sheets of molten rock welled up from far below the surface and either spread out over the surface, with additional deposits of sandstone laid down above it later, or forced itself horizontally from a central fissure between the strata of rock already formed. This lava cooled to form a dark-colored, firm-textured, minutely crystalline rock commonly known as "trap". Great "faults" occurred in the earth's surface, so that the truncated edges of these formations are now exposed as nearly perpendicular cliffs, almost invariably facing in a westerly direction in this State. The chief areas of rock of this type are shown in black in Figure 1.

The Effect of Glaciation

At a period estimated as between 15,000 and 30,000 years ago, the great ice age was in progress. The effects brought about by the advance and retreat of that great sheet of ice must be realized if we are to understand many important differences to be found in the soils described in this bulletin.

That great mass, thick enough to drown the summit of Mount Washington in its icy depths, flowed like so much molasses, yet infinitely slower, down across the northern part of our continent until it reached a climate sufficiently warm to melt it back as fast or faster than it oozed southward. The farthest extent of the glacier in our section of the country was just south of Long Island. Thus the entire area of Connecticut was covered with ice.

In its advance, the glacier scraped over and scooped out the original soil that had probably covered the surface previously, and mixed it with rocks and rock fragments which it dug or snatched from the jagged edges of the irregular slopes. Much of this material was deposited as a thin mantle of till from several inches to a few feet in depth, overlying the fresh and unweathered surface of the resistant rock masses beneath. Occasionally the loose material being dragged along under the ice accumulated to considerable thickness, and piled up to such an extent that the ice rode over and around it, leaving long, narrow and smoothly convex ridges of material, usually a mile or so in length and about a quarter of a mile wide, rising to

a height of from 75 to 200 feet above the surrounding surface. These ridges are called drumlins. Many occur in the State, particularly in the western portion, as in the towns of Goshen, Litchfield and Bethlehem, and in northeastern Connecticut with best development in Woodstock and Pomfret.

In most cases the greater part of the material thus spread upon the surface has been derived from rock formations either directly underlying or occurring within a mile or so to the northward. Frequently the influence of a single small outcrop of a peculiarly colored rock can be clearly traced.

The ice sheet at its southernmost limit deposited ridges of loose, coarse material highly mixed with boulders, called terminal moraines. These are not found in Connecticut but at intervals in the melting of the glacier the ice front may have remained nearly stationary for certain periods of time. Thus there were deposited locally, deep and irregular deposits of coarse and comparatively loose morainic material.

As the ice melted, its surface was gradually lowered until the higher hills emerged, and the water, released through melting, raced wildly down the temporary valleys thus formed between the edge of the glacier and the hill, frequently piling up irregular hummocks and short ridges of sand and coarse gravel. These deposits are called "kames". In other cases the water from the melting ice flowed for some distance under the glacier, dropping sand and coarse gravel along its more or less serpentine channel. When the ice had all disappeared, the former course of the sub-glacial stream was left as a long, narrow and winding low ridge, usually rising 20 or 30 feet above the relatively level ground of the present valley floor. These formations are called "eskers". Kames and eskers are frequently found along the valleys of most small streams of the State, particularly those that flow toward the south.

With further melting of the ice, the broader valleys emerged, the lower portions of which were occupied by ice remnants and glacial debris. Extensive, nearly level plains of sandy material were built up by the swollen streams which flowed over these areas. When the ice melted to permit an outlet for the water at a lesser elevation, such a plain appeared as a terrace above the general level of the new stream flow. In many cases a series of successively lower terraces were thus formed until the entire valley was cleared of ice. This is the most logical explanation for the extensive areas of sandy soils, containing no boulders or large stones, which occur in the Connecticut Valley north of Middletown, and in smaller belts elsewhere along most of the larger streams of the State.

In some cases, the valley was dammed by the ice-deposited material after the glacier had melted from most of the low-lying lands in the immediate vicinity. Into the quiet waters of the lake thus formed were gradually deposited the fine silt and clay washed from the melting glacier to the north. In the summer, coarser silt and very fine sand settled out on the bottom of the lake. In the winter, little additional coarser material was supplied because of decreased melting of glacial ice. The fine clay particles which require a long time to settle were then deposited. The clay formations of these glacial lake bottoms show a laminated effect of alternate layers of clay and silt, which record the procession of years during that period. Such clay deposits occur in the Connecticut Valley north of Rocky Hill and in the Mattabesset and Quinnipiac valleys.

When all the ice had melted from the headwaters of our streams, they subsided to their present size. Since then their occasional floods have deposited some alluvial material on the areas commonly known as bottom land, especially along the Connecticut River, where the width of such deposits sometimes exceeds half a mile. This recent alluvial material forms soils which are still being periodically changed by new flood deposits. Much fresh sand and silt was added to the Connecticut bottom lands in the great flood of 1927.

Climate

Given sufficient time, the effects of climate on soil formation are such as completely to blot out the differences in kind of rock from which the soils were originally formed. In regions where the soil has been undisturbed for vast periods of time, and where very little erosion and consequent exposure of fresh material from below has taken place, as in many areas in the southern and western parts of the United States, the soil is practically the same, whether originally derived from granite, sandstone or limestone.

Different combinations of rainfall and temperature have thus produced major differences in soils in various parts of the world. In southern New England, regardless of the type of rock or the mode of deposition of the material, all the soils possess certain points of similarity which are distinct from the soils of northern New England, the South, the Middle West, the Great Plains and the arid regions of the Southwest. The soils of Connecticut lie at the border of a Climatic Soil Region and show gradations from the general characteristics of the soils of the Middle Atlantic States to those of northern New England and southeastern Canada.

Since the soils of Connecticut are derived from material deposited on the surface by glacial action in geologically very recent time, and the rock material is for the most part rather resistant to the soil-forming processes brought about by our particular type of climate, the climatic effects are not as pronounced as might be otherwise expected.

Drainage

Differences in the rapidity with which percolating waters pass down through the soil, due to the presence or absence of heavier or more clay-like substratum, have caused the soils to show corresponding variations in their weathered horizons. A periodical or permanent waterlogging of the soil reveals evidences of this condition in the soil itself, such as mottled coloration of the subsoil (streaked with rusty, reddish yellow and gray), and the accumulation of more organic matter in the surface soil.

Erosion

Soils occurring on slopes have often been modified by the washing away of the uppermost layers, containing much of the organic matter. The finer soil particles are thus removed more readily, leaving behind larger relative proportions of sand, gravel and boulders. The effective depth of the soil may be diminished. When erosion is severe, deep gulleys are formed, not only removing much soil, but seriously interfering with the suitability of the surface for tillage operations.

Soil erosion under natural growth of forest or grass is kept at a minimum; yet the cumulative effect of many thousands of years of this slow erosion, accomplished chiefly by stream cutting, has resulted in the formation of the major topographic features of our landscape.

Erosion under artificial conditions of frequent tillage is greatly accelerated, and the soils of many fields have been greatly modified under agricultural use. Many slopes have been denuded of much of the original surface soil, and are now unusually gravelly or stony and poor in organic matter. Depressions and level areas at the base of slopes have been built up, but the choking of natural drainage channels with clay and silt washed down from eroded areas has often contributed to their present excessive wetness. Serious gulleys and bare, steep banks have been cut back, especially along farm roadways extending up the slope.

It has been generally believed that erosion is not a soil problem in southern New England. Grass, as mowing land or pasture, protects most of our hillier areas. Most of our soil types are able to absorb water rapidly during rainfall. The rills of water coursing over the surface of bare soil during heavy rains or periods of snow melting are checked by obstructing rock fragments or gravel. It is doubtless true that these conditions have generally prevented the obvious manifestations of soil erosion. Yet the building up of soil on the uphill side of stone walls, even in fields rarely cultivated, is mute evidence that considerable depletion from farther up the slope has taken place.

On fields kept under cultivation almost continuously, as in potato, tobacco or vegetable culture, or in cultivated orchards, erosion is playing havoc with some of our best soils, and has already greatly modified the soil pattern in many fields. It is not within the scope of this publication to deal with soil management practices. Yet if our present soil resources are to be maintained, soil erosion must be drastically dealt with on many such areas.

Clearing and Cultivation

Immediately after the soil is cleared, rapid decomposition of the organic accumulations of the original forest floor begins to take place. This process is often hastened by burning, and goes on more rapidly when the soil is put under the plow, exposing a greater surface to the air and quickening the activities of the micro-organisms of the soil. Erosion is often permitted to take place. Crops are removed. Manure, fertilizer, or lime is added to the soil. The different soil horizons that occur within a few inches of the surface are mixed together. A soil that has once been cultivated, or even only cleared and pastured for a few years, is recognizably different, for at least a century after it has reverted to woodland, from adjacent areas which have always been in forest.

CONNECTICUT SOILS COMPARED WITH OTHER SOILS OF THE UNITED STATES

As has already been mentioned, climate is the most important determining factor in the broad differences in soil which occur in various regions.

To the north of us, beginning to be fully developed in the higher areas of Litchfield County, lies a region of soils evolved under conditions of long

cold winters, heavy snowfall, and short, mild summers with abundant rainfall. The soils in their virgin state show a strikingly characteristic profile. (See Figure 2.) Beneath about three or four inches of dark brown, slowly decomposing forest humus, there are about two or three inches of a peculiar, light gray, sandy material (A horizon). Directly under this lie about two inches of dark coffee-brown, firm and compact mineral soil, becoming reddish yellow-brown and more sandy in the several inches immediately below it (B horizon). The soils of this region possessing the gray layer directly under the leaf mold, belong to the great soil group of podsols.

Southern New England and the region south to Washington, D. C., and westward to the prairies, have soils developed under the action of more moderate winters and warmer summers, with abundant rainfall well distributed through the year. The typical virgin soil (See Figure 2) has a thin, well decomposed layer of leaf mold resting upon five or six inches of

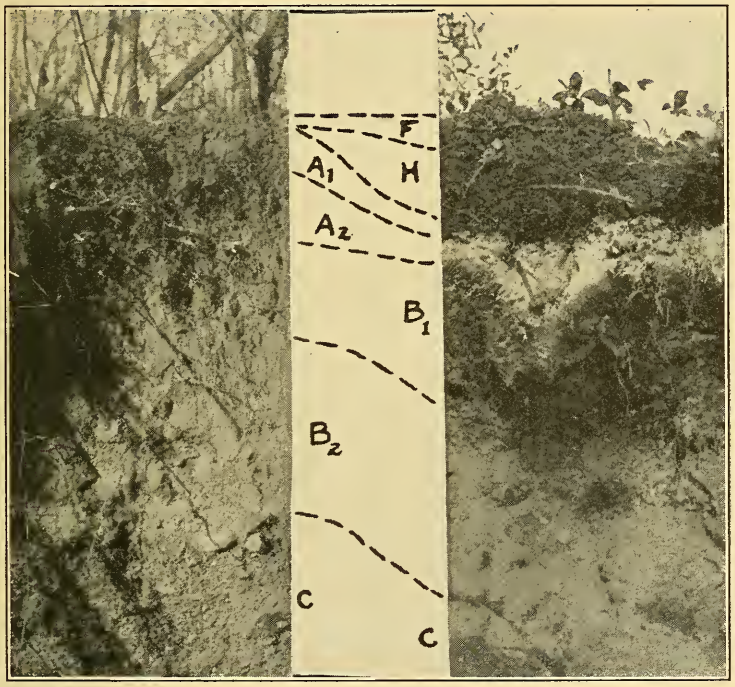


FIGURE 2. Typical non-podsolized forest soil profile of Connecticut (left) and strongly podsolized forest soil profile of northern New England. Note gray A_2 horizon of the latter, with dark colored B_1 horizon below it. The latter type of profile is occasionally found in northwestern and eastern Connecticut.

brown mellow loam. Under this the subsoil (B horizon) is somewhat heavier in texture, yellow-brown to reddish yellow-brown in color and extending to the depth of 24 to 36 inches from the surface. Below this, the substratum (C horizon) is usually of a grayish or grayish brown color and coarser in texture than the subsoil.

Most Connecticut soils of this character are members of the brown podsolic great soil group.

However, there is an evident gradation toward the podsol character in many areas, particularly in northern Litchfield County. Besides this, the resistant character of the rock material and the relatively short time since glaciation have given the soils of Connecticut a somewhat different character than is typical of the climatic soil group.

In the South we have red and yellow soils, in the eastern prairies black soils without lime hardpan, in the western prairies black soils with lime hardpan, in the great plains chestnut-colored soils, and in the arid regions of the desert gray and brown soils. All these are strikingly different from any of the soils of Connecticut, but their characteristics need not be described here.

GENERAL DESCRIPTION OF THE TOPOGRAPHIC FEATURES OF THE STATE

Connecticut is usually divided into three distinct physiographic regions. A central belt, extending north and south, about 20 miles wide at the Massachusetts border, and narrowing to five miles at New Haven, is known as the Central Lowland. (See Figure 1, area IV.) That part of the State west of this belt is called the Western Highland, while the area east of it is designated the Eastern Highland. In northwestern Litchfield County and in the vicinities of Danbury and New Milford an area should also be recognized which might be called the Limestone Valleys.

The Central Lowland is characterized by a general low elevation, ranging from an average of about 50 feet at New Haven to about 200 feet at the Massachusetts border. Narrow belts of prominent trap-rock ridges, extending in a general north-south direction, with sharp cliffs on their western faces and gentler slopes toward the east, rise to heights of from 200 to 400 feet above the adjacent lowland.

There are three general areas in the Central Lowland where extensive stretches of level or nearly level plains are to be found. The largest of these is in the Connecticut River Valley north and east of Hartford, in the Farmington Valley between Plainville and Southwick, Mass., and in the Quinnipiac Valley between New Haven and Meriden. Elsewhere the country is rolling to moderately hilly.

The Western Highland (See Figure 1, area I) rises abruptly from the western edge of the Central Lowland to about 200 feet just west of New Haven and about 800 feet at the Massachusetts line. Toward the northwest there is a general rise to more than 2,000 feet at the northwestern corner of the State.

There is a considerable local range in elevation, and the greater portion of the region is hilly to mountainous in relief. Exceptions to this are extensive areas where the uplands flatten out into long ridges with smooth outline and more gentle slopes. The ridges are of a uniform character, with their longer axes about three-quarters to one and one-half miles long and from one-quarter to three-quarters of a mile wide. These have been previously described as drumlins. The most extensive development of this type of topography is in central Litchfield County.

The Limestone Valleys, (See Figure 1, area III) lying within the Western Highland region, are from 200 to 1,000 feet lower in elevation. This is due to the more easily weathered type of rock. The topography is rolling to moderately hilly, in sharp contrast to the adjacent mountainous slopes.

The Eastern Highland (See Figure 1, area II) rises abruptly from the eastern edge of the Central Lowland. The elevations are in general somewhat lower than in the Western Highland, ranging up to about 1,200 feet. Mountainous topography is only local in occurrence, and for the most part the surface is hilly, with a marked irregularity of relief. Since the hills are smaller, there are many more of them in a given area than in northwestern Connecticut.

The drumlin type of topography occurs to a more limited extent in the Eastern Highland. Hills of this sort are numerous only in the vicinity of Woodstock, Pomfret and Lebanon. Isolated drumlins may be found elsewhere, but they make up a small proportion of the total area.

In the Eastern Highland region many of the valleys are partially or completely occupied by gravelly, mound-like knolls of the kame type, with occasional narrow serpentine elevations called eskers. The best development of such topography is in the Natchaug and Quinnebaug valleys. It occurs in the Western Highland in local areas only.

In both the Eastern and Western Highlands the larger streams may have level, sandy terraces at intervals along their courses. Flood plains are narrow and of little importance along the smaller streams of the highlands, and the only flood plains of any considerable size border the Connecticut River, in the portion of its course that lies in the Central Lowland.

Small inland swamps and bogs of from 10 to 500 acres in size occur in almost every town. Their total area amounts to about 3 percent of the State.

Along the shore of Long Island Sound many tidal marshes are developed. As fingers these may extend two or more miles inland, and they are sometimes 1,000 or more acres in size. Frequently the tidal swamp is separated from the sea by narrow belts of sand thrown up by the waves and blown inland by the wind. The area of such formations is insignificant, being occupied almost entirely by shore cottages.

SOIL CLASSIFICATION

The system of soil classification now used in this country was developed by the Soil Survey Division, Bureau of Plant Industry (formerly Bureau of Soils), of the U. S. Department of Agriculture. The fundamental unit is the soil type. Soils that are alike in all respects except in their relative content of clay, silt and sand are considered as a soil "series", to which a distinctive name is applied. The series, in combination with the textural designation, identifies the soil type. Thus the soils found in the broad terrace lands of Hartford County are commonly of the Merrimac series, with various types, such as Merrimac sandy loam, Merrimac fine sandy loam and Merrimac loamy sand.

The soils of Connecticut have not been completely mapped in detail. However, those within the areas indicated in Figure 3 have been systemati-

cally studied, and much reconnaissance has been done in all parts of the State. The Soil Conservation Service of the U. S. Department of Agriculture surveyed the soils of 50,000 acres in the Scantic River Watershed in 1936. It is reasonable to believe that practically all the soil types of the State have been identified. Most of them have been mapped and described in detail in the federal soil survey reports for the adjoining counties of Massachusetts, Rhode Island and New York, and in the reports for New London and Windham counties and the Connecticut Valley area. However, the latter are based upon field work done before the present system of classification was fully developed.

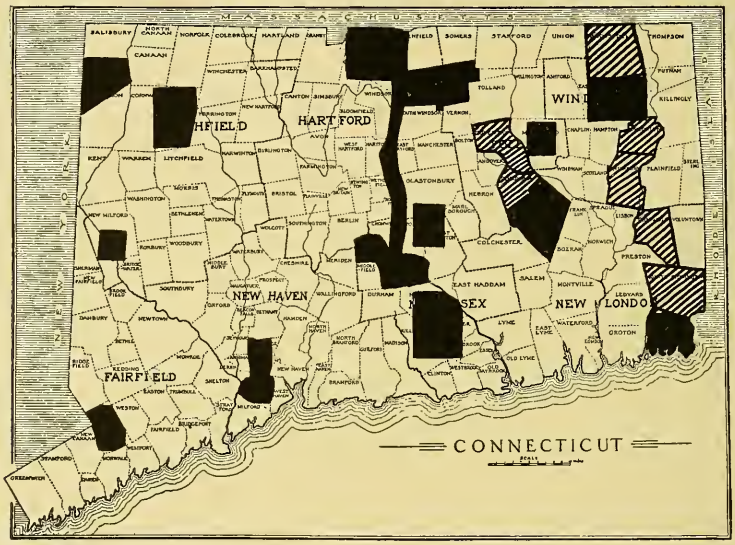


FIGURE 3. Areas over which the soils have been studied in detail. Solid black: soil and land use surveys of the entire area; shaded, surveys of selected farms within the towns.

It may be some time before detailed soil surveys, by counties, will be undertaken by this State in coöperation with the Federal Government. In the meantime soil identification must be done by the individual on the ground, with or without the assistance and guidance of county agricultural agents, teachers of vocational agriculture, extension specialists and other competent farm advisers. In order to facilitate the recognition of soil types and their relationships, a key has been prepared. In this, the soils are described chiefly on the basis of their appearance in fields that have been subjected to clearing and cultivation. The characteristics of the uppermost soil layers as they appear in areas long under forest are quite distinctive, and have been discussed at considerable length in Bulletin 342, "The Profile Characteristics of New England Forest Soils".

The numbers preceding the soil series are key designations now in use on all soil maps prepared by the Soils Department of this Station.

A Key to the Soil Types of Connecticut

1. UPLAND SOILS, DEVELOPED FROM UNSTRATIFIED GLACIAL DEPOSITS (TILL)

A. Good surface drainage and unimpeded underdrainage

1—Topography: irregular, of morainic character, without bedrock outcrops

(a) *Surface soil:* light brown, mellow, few to many well rounded boulders
Subsoil: brownish yellow, friable, stony or gravelly
Substratum at 28-36 inches—grayish yellow to brownish gray, loose, very stony and gravelly; composed chiefly of mixed granite gneiss and schist; unchanged to several feet in depth

(10) **Plymouth loamy sand**
" " " , stony phase
Plymouth fine sandy loam
" " " " , stony phase

(Occurrence: small isolated areas, chiefly in extreme southeast portion of State)

2—Topography: hilly to mountainous; irregular slopes (8-50% or more); occasional to frequent bedrock outcrops

(a) *Surface soil:* medium to dark brown, mellow, few to many boulders
Subsoil: medium light yellow-brown, friable
Substratum at 28-36 inches—gray to brownish gray; moderately loose; containing little clay; much stone and irregular rock fragments of all sizes, composed chiefly of light-colored granite gneiss and schist; practically unchanged to unweathered bedrock at 3-20 feet

(11) **Gloucester fine sandy loam**
" " " " , stony phase
Gloucester loam
" " , stony phase

(Occurrence: general over most of Eastern and Western Highland, particularly in hillier areas)

(b) Not distinguishable from above after being cultivated. Under natural woodland conditions surface soil shows definite evidence of podsol formation, with light gray A_2 horizon more than .5 inch in thickness. Below 8 inches, identical to Gloucester

(9) **Hermon fine sandy loam,** stony phase

(Occurrence: occasional, in woodland areas in northern Litchfield, northern Windham and eastern New London counties)

(c) *Surface soil:* light brown, mellow, few to many angular rock fragments
Subsoil: light brownish yellow, friable
Substratum: light gray, loose, composed chiefly of disintegrating fragments of quartz-schist; at 28-36 inches, grades to bedrock at 3-20 feet

(12) **Coloma loamy fine sand**
" " " " , stony phase
Coloma fine sandy loam
" " " " , stony phase

(Occurrence: occasional in North Canaan, Killingly, Plainfield and Sterling)

(d) *Surface soil:* medium brown often with slight reddish cast, mellow, few to many schistose rock fragments
Subsoil: bright yellow-brown to reddish yellow-brown, friable to firm
Substratum at 28-36 inches—light yellowish brown; loose to firm; composed chiefly of partially weathered fragments of rust-colored mica schist; grades to bedrock at 3-15 feet

(13) **Brookfield fine sandy loam**
" " " " , stony phase
Brookfield loam
" " , stony phase

(Occurrence: extensive in many parts of Eastern and Western Highlands, expecially in rougher areas)

(e) *Surface soil:* medium brown, mellow, few to many large angular rock fragments
Subsoil: yellowish brown, friable to firm
Substratum at 28-36 inches—light yellowish brown to grayish brown; loose to firm; composed chiefly of partially weathered fragments of gneiss or granite; grades to bedrock at 3-15 feet

(14) **Hinsdale fine sandy loam**
" " " " , stony phase
Hinsdale loam
" " , stony phase

(Occurrence: western portion of Eastern Highland, chiefly west of Connecticut River, especially in rougher areas)

(f) *Surface soil:* medium brown, often with slight reddish cast, mellow, few to many sharply angular olive-gray chlorite schist rocks
Subsoil: reddish yellow-brown to bright yellow-brown, firm, usually somewhat more loamy than surface soil
Substratum at 28-36 inches—light gray to pinkish gray; loose to firm; composed chiefly of weathered chlorite schist fragments; grades to bedrock at 3-15 feet

(16) **Maltby fine sandy loam**
" " " " , stony phase
Maltby very fine sandy loam
" " " " " , stony phase

(Occurrence: Woodbridge, West Haven and Orange, chiefly in rougher areas)

(g) *Surface soil:* medium to dark chestnut brown to reddish brown, friable, numerous, roughly angular "trap" rocks of all sizes
Subsoil: reddish yellow-brown to bright yellow-brown, firm
Substratum at 24-36 inches—yellow-brown; loose to firm; composed chiefly of angular fragments of weathered trap rock, slightly mixed with yellow clay; grades to bedrock at 3-15 feet

(21) **Holyoke very fine sandy loam**
Holyoke loam
" " , stony phase

(Occurrence: along slopes adjacent to precipitous trap rock ranges rising from the Central Lowland)

(h) *Surface soil:* light to medium brown to gray brown; friable to firm; numerous "cobbles" and small rounded fragments of coarse triassic conglomerate (arkose)
Subsoil: light reddish yellow-brown; firm
Substratum at 24-36 inches—pale reddish gray; loose; composed chiefly of pebbly fragments of disintegrating coarse triassic conglomerate; grades to unbroken bedrock at 3-15 feet

(23) **Middletown loam**
" " , stony phase

(Occurrence: local, on rougher areas of Central Lowland, especially in Middletown and northeastern Durham)

3—Topography: hilly to strongly rolling; moderately irregular slopes (5-25%); occasional to frequent bedrock outcrops

(a) *Surface soil:* medium to dark brown, often with slight reddish cast; mellow to firm; few to many angular schist rocks
Subsoil: deep yellow-brown, often with slight reddish cast; friable to firm
Substratum at 28-36 inches—grayish brown; loose to firm; composed chiefly of disintegrating and partially weathered diorite schist, which on disintegration forms a sandy mass of black and gray particles only slightly micaceous; grades to bedrock at 3-15 feet

(15) **Wilton fine sandy loam**
" " " " , stony phase
" **loam**
" " , stony phase

(Occurrence: New Milford south to the Sound, chiefly in Fairfield County)

(b) *Surface soil:* medium to dark grayish brown; friable to firm; few to many dark gray "slaty" rocks
Subsoil: yellowish olive to olive-drab; firm to slightly compact
Subtratum at 28-36 inches—bluish gray to dark olive-gray; loose to slightly compact; composed chiefly of disintegrating and only slightly weathered phyllite or slate fragments; grades with only slight change to unbroken bedrock at 3-15 feet

(17) **Hollis loam**
" " , stony phase
" **shale loam**
" **silt loam**

(Occurrence: Bethany southwestward to Long Island Sound)

(c) *Surface soil:* medium grayish brown; friable to firm; few to many shaly rocks
Subsoil: greenish yellow to yellowish olive; firm to slightly compact
Substratum at 24-30 inches—yellowish olive; firm to moderately loose; composed chiefly of disintegrating and partially weathered shale or argillaceous schist fragments; grades to bedrock at 3-20 feet.

(18) **Dutchess loam**
" " , stony phase
" **silt loam**
" **shale loam**

(Occurrence: Salisbury and Sharon, in hillier sections)

(d) *Surface soil:* medium to dark olive-brown; friable to firm; few to many shaly rocks, with occasional limestone fragments
Subsoil: greenish yellow to yellowish olive; firm to slightly compact
Substratum at 24-30 inches—olive-drab to yellowish olive; firm to moderately loose; composed chiefly of a mixture of disintegrating and partially weathered shaly schist and limestone, giving effervescence with acid; grades to bedrock of schist or limestone at 3-20 feet.

(19) **Pittsfield fine sandy loam**
" " " " , stony phase

(Occurrence: Upper Housatonic Valley, south to Ridgefield, in hillier sections)

(e) *Surface soil:* light brown to medium yellowish brown, mellow to friable; few to many rocks, chiefly of impure limestone
Subsoil: reddish yellow-brown to pale yellow-brown; firm
Substratum at 24-36 inches—light olive-gray to nearly white; loose to firm; composed chiefly of disintegrated limestone, giving effervescence with acid; grades to unbroken bedrock at 3-15 ft.

(20) **Dover fine sandy loam**
" " " " , stony phase

(Occurrence: upper Housatonic Valley south to Ridgefield, on low-lying hills with irregular slopes)

B. Good surface drainage, and only slightly impeded underdrainage (occasional seepage from slopes)

1—Topography: hilly, with moderate, slightly irregular slopes (5-30%); bedrock outcrops few to none

(a) *Surface soil:* medium to dark brown; friable to firm; few to many boulders of gneiss and schist
Subsoil: light yellow-brown; firm
Substratum at 24-32 inches—light grayish brown to olive gray; slightly mottled in upper portion; firm to slightly compact; porous; composed chiefly of well-disintegrated and slightly weathered glacial till derived chiefly from gneiss and schist; practically unchanged to gneiss or schist bedrock at 10-25 feet.

(22) **Essex fine sandy loam**
" " " " , stony phase
" **loam**
" " , stony phase

(Occurrence: scattered in Eastern and Western Highland, associated with larger areas of Gloucester soils)

(b) *Surface soil:* dark brown to dark grayish brown; mellow; few to many boulders of gneiss and schist; under natural forest cover, shows definite podsol formation, with .5 inch or more of gray A_2 horizon
Subsoil: yellowish brown grading to greenish yellow with depth; firm to slightly compact
Substratum at 28-36 inches—greenish gray; compact; slightly porous; composed chiefly of well-disintegrated and only slightly weathered glacial till derived from gneiss and schist; practically unchanged to bedrock at 10-25 feet

(30) **Becket loam**
" " , stony phase

(Occurrence: on higher ridges in northern Litchfield County)

(c) *Surface soil:* medium to dark grayish brown; friable to firm; few to many fragments and boulders of schist
Subsoil: light yellow-brown, with slight olive cast with increasing depth; firm to slightly compact
Substratum at 24-28 inches—yellowish olive to drab; very compact, slightly porous; composed chiefly of a heavy, well-decomposed mass of glacial till with schist material predominant; extends with little change to bedrock at 25-75 feet

(32) **Charlton fine sandy loam**
" " " " , stony phase
" **loam**
" " , stony phase

(Occurrence: very common in less rugged portions of both Eastern and Western Highland, particularly in central Windham County, and in central and southwestern Litchfield County)

(d) *Surface soil:* medium brown, occasionally with slight reddish cast; firm to hard; few to many boulders of granite gneiss; with occasional Triassic sandstone rocks
Subsoil: light brown; firm to slightly compact
Substratum at 24-30 inches—grayish brown, with slight reddish cast; slightly to moderately compact; porous; composed chiefly of well-disintegrated and partially weathered glacial till derived from granite gneiss with a slight proportion of triassic sandstone material; practically unchanged to granite gneiss bedrock at 10-25 feet

(33) **Haddam fine sandy loam**
" " " " , stony phase
" **loam**
" " , stony phase

(Occurrence: scattered, near western edge of Eastern Highland, in Middlesex and New Haven counties, chiefly associated with larger areas of Hinsdale soils)

(e) *Surface soil:* dark gray-brown, with olive cast; mellow to firm; few to numerous fragments of slaty schist
Subsoil: greenish yellow, firm to slightly compact
Substratum at 28-36 inches—grayish olive; moderately compact; composed chiefly of partially disintegrated and only slightly weathered till derived from schist and limestone; effervesces with acid

(36) **Lenox fine sandy loam**
" " " " , stony phase
" **loam**
" " , stony phase

(Occurrence: in upper Housatonic Valley, south to Ridgefield, chiefly in Salisbury and Sharon)

(f) *Surface soil:* light to medium brown, with slight reddish cast; firm; few to numerous fragments of triassic sandstone
Subsoil: reddish yellow-brown; firm
Substratum—light reddish brown to reddish gray; moderately compact; composed chiefly of coarse, disintegrated triassic sandstone glacial till; practically unchanged to bedrock at 10-25 feet

(37) **Cheshire sandy loam**
" **fine sandy loam**
" " " " , stony phase
" **loam**
" " , stony phase

(Occurrence: general on hilly areas of Central Lowland in Hartford, Tolland, Middlesex and New Haven counties)

C. Fair to good surface drainage, moderate to slow underdrainage (considerable seepage from lower slopes)

1—Topography: hilly to rolling, with well-rounded slopes (5-20%); bedrock outcrops, none

(a) *Surface soil:* medium to dark gray-brown; friable to firm; few to many boulders of gneiss and hard schist
Subsoil: light yellow-brown, with slight olive cast at increasing depth; firm to slightly compact
Substratum at 24-30 inches—olive-drab to greenish gray; very compact, slightly porous; composed chiefly of a heavy, well-decomposed mass of glacial till of granite-gneiss and schist material; extends with little change to bedrock at 20-50 feet

(31) **Woodbridge fine sandy loam**
" " " " , stony phase
" **loam**
" " , stony phase

(Occurrence: very common on less rugged portion of Western Highland, Woodbridge north to Litchfield, and westward)

(b) *Surface soil:* dark to very dark gray-brown; mellow; few to many boulders of light gray gneiss and quartz-schist
Subsoil: grayish yellow-brown, slightly mottled in lower portion; firm to slightly compact
Substratum at 24-30 inches—olive-gray to light gray; very compact; composed chiefly of a dense, sandy mass of glacial till derived chiefly from gneiss and schist high in quartz; extends unchanged to bedrock at 15-35 feet.

(39) **Taugwank fine sandy loam**
" **loam**
" " , stony phase

(Occurrence: occasional on less rugged areas of New London and Middlesex counties, in Eastern Highland)

(c) *Surface soil:* dark grayish brown; mellow; few to many boulders of dark gray schist
Subsoil: yellowish olive, usually heavier in texture than surface soil, firm to slightly compact
Substratum at 18-24 inches—olive-drab to grayish olive; very compact; composed chiefly of a heavy, well-decomposed mass of glacial till of schist material; extends with little change to bedrock at 20-50 feet

(40) **Litchfield loam**
" " , stony phase

(Occurrence: in broad drumlin ridges in north-central Litchfield County)

(d) *Surface soil:* dark grayish brown, with slight olive cast; friable to firm; few to numerous fragments and boulders of schist, gneiss and phyllite
Subsoil: yellowish olive-brown, grading to light yellowish olive with increasing depth; slightly compact
Substratum at 20 inches—pale yellowish olive, very compact, loamy; becomes coarser and somewhat less compact below 30 inches; composed chiefly of a finely disintegrated mass of mixed schist, phyllite and gneiss; extends with little change to bedrock at 50-75 feet

(35) **Paxton loam**
" " , stony phase

(Occurrence: on smoothly rolling, well-rounded drumlin-type hills, most common in northern Windham County, chiefly in Woodstock)

(e) *Surface soil:* dark olive-brown; mellow to friable; numerous small fragments of slaty phyllite; but few boulders
Subsoil: olive-brown to grayish olive; loamy; firm
Substratum at 20-24 inches—dark olive to bluish olive; compact; heavy; composed chiefly of a well disintegrated and partially decomposed mass of phyllite material; extends with little change to bedrock at 20-50 feet

(34) **Bernardston loam**
" " , stony phase

(Occurrence: on smoothly rolling, well-rounded hills, in towns of Woodbridge, Orange and Milford, in association with areas of Hollis soils)

(f) *Surface soil:* medium grayish brown; firm; few to numerous fragments of slaty schist and impure limestone
Subsoil: light yellowish brown, with slight olive cast; firm to slightly compact
Substratum: greenish gray to bluish gray; compact; composed chiefly of a heavy dense mass of glacial till derived chiefly from slaty schist with some limestone; effervesces with acid; extends unchanged to bedrock at 20-50 feet

(42) **Stockbridge loam**

(Occurrence: chiefly in northwestern Litchfield County, in Sharon and Salisbury)

(g) *Surface soil:* medium red brown; firm to hard; few to numerous flat fragments of Triassic sandstone and shale
Subsoil: light reddish brown; firm to slightly compact
Substratum at 24-30 inches—light reddish brown to brownish red; very compact, moderately porous; composed chiefly of a heavy mass of glacial till derived from red Triassic shale and fine grained sandstone; extends unchanged to bedrock at 25-75 feet

(38) **Wethersfield fine sandy loam**
" **loam**
" " , stony phase
" **clay loam**

(Occurrence: Frequent on well-rounded drumlin hills of Central Lowland section)

D. Fair surface drainage, poor underdrainage (much seepage from lower slopes)

1—Topography: rolling ridge tops, with well-rounded slopes (3-15 %); bedrock outcrops, none

(a) *Surface soil:* very dark gray-brown; mellow; few to numerous boulders and schist fragments
Subsoil: olive-drab, moderately mottled; moderately compact
Substratum at 18-24 inches—mottled olive-gray and rusty brown, becoming grayer at greater depth; very compact; composed of heavy glacial till derived from mixed schist and gneiss; extends to bedrock at 50-75 feet

(41) **Sutton loam**
" " , stony phase

(Occurrence: occasional on broader ridge tops, associated with Charlton soil)

2—Topography: irregular slopes, usually either bench-like or as partially expressed swales where seepage from higher areas is prevalent; bedrock outcrops none

(a) *Surface soil:* dark grayish brown; mellow; numerous to many boulders of gneiss and schist
Subsoil: yellow-brown, becoming mottled at lower depth; friable to firm
Substratum at 24-30 inches—mottled grey and rusty brown, grading to light gray at lower depth; firm to moderately compact; composed of gneiss and schist material; extends to bedrock at variable depth, usually within 10 feet

(43) **Peru fine sandy loam**
" " " " , stony phase
Peru loam
" " , stony phase

(Occurrence: frequent small areas in association with Gloucester, Brookfield and similar soils; widely distributed over both Eastern and Western Highland)

(b) *Surface soil:* dark grayish brown; friable to firm; numerous fragments and larger slabs of reddish colored sandstone and shale
Subsoil: yellow-brown, with slight reddish cast, becoming mottled with gray and rusty brown with depth
Substratum at 24-30 inches—mottled pinkish gray and rusty brown, grading to reddish gray at lower depth; firm to moderately compact; composed of reddish-colored Triassic sandstone and shale material; extends to bedrock at variable depth, usually within 20 feet

(44) **Whippany fine sandy loam**
" " " " , stony phase
" **loam**
" " , stony phase
" **clay loam**

(Occurrence: frequent small areas in association with Cheshire and Wethersfield soils in the Central Lowland sections of Hartford, Tolland, New Haven and Middlesex counties)

E. Poor surface drainage, impeded underdrainage, receiving seepage water from adjacent areas of glacial till

1—Topography: shallow swales, ravines or basal slopes

(a) *Surface soil:* very dark grayish brown to gray-black; mellow; numerous to many boulders of gneiss and schist

Subsoil: mottled gray, yellow and rusty brown; firm

Substratum at 20-24 inches—light olive-gray to bluish gray; firm to moderately compact; usually much heavier in texture than surface; stony; composed of glacial till derived from mixed gneiss and schist; bedrock usually within 10 to 15 feet

(50) **Whitman sandy loam**
" " " , stony phase
Whitman loam
" " , stony phase
Whitman clay loam
" " " , stony phase

(Occurrence: in small areas associated with the till soils of both Eastern and Western Highlands)

(b) *Surface soil:* gray-black to black, mellow; few to numerous boulders of schist, quartzite and impure limestone

Subsoil: mottled gray, yellow and rusty brown, firm

Substratum at 20-24 inches—light gray to bluish gray; compact; calcareous (effervesces with acid); slightly to moderately stony; composed of disintegrated and decomposed limestone, usually mixed with gneiss and schist; bedrock usually within 10 to 15 feet

(51) **Lyons loam**

(Occurrence: small areas in limestone section of Western Highland, chiefly in Salisbury, Sharon, Cornwall, New Milford and Danbury)

(c) *Surface soil:* very dark brown to gray-black; mellow; few to numerous sandstone or shale slabs or boulders of trap

Subsoil: mottled pinkish gray, reddish yellow and rusty brown; firm

Substratum at 20-24 inches—pinkish gray to light reddish brown; moderately compact; usually heavier than surface or subsoil; composed of glacial till material derived from sandstone and shale of Triassic formations; bedrock usually within 10 to 15 feet

(52) **Whitfield loam**
Whitfield clay loam

(Occurrence: small areas in association with Wethersfield and Cheshire soils of Central Lowland)

II. VALLEY SOILS DEVELOPED FROM WATER-LAID MATERIAL OF PREHISTORIC ORIGIN (STRATIFIELD GLACIAL DEPOSITS)

A. Good surface drainage and unimpeded underdrainage

1—Topography: irregular, with rounded knolls and short ridges; slopes variable (3-15 percent). No bedrock outcrops; no large boulders; well-rounded cobbles prevalent on a few types. More or less gravelly

(a) *Surface soil:* medium to light brown; mellow to friable; moderately to excessively gravelly or sandy
Subsoil: yellow-brown becoming paler in color with depth; firm
Substratum at 28-30 inches—brownish gray to yellowish gray; very gravelly or sandy; composed of water-deposited gneiss and schist material

(60) **Hinckley loamy sand**
Hinckley sandy loam
" " " , gravelly phase
Hinckley fine sandy loam
" " " " , gravelly phase

(Occurrence: common along valley sides and near drainage divides throughout Eastern and Western Highlands)

(b) *Surface soil:* medium brown; mellow to friable; moderately to excessively gravelly
Subsoil: yellow-brown, with slight reddish cast; firm
Substratum at 28-30 inches—light yellowish brown to brownish olive; gravelly; composed of water-deposited phyllite and chlorite material

(63) **Hancock fine sandy loam**
" " " " , gravelly phase
Hancock loam
" " , gravelly phase

(Occurrence: in Woodbridge, Orange and Milford, adjacent to areas of *Hollis* soils)

(c) *Surface soil:* medium brown; mellow; moderately to excessively gravelly or sandy
Subsoil: yellow-brown, occasionally with slight reddish cast; firm
Substratum at 28-36 inches—light gray to yellowish gray; gravelly or sandy; composed of a mixture of water-deposited limestone and schist material; occasionally partially cemented by infiltration of carbonates from upper horizon; effervesces slightly to strongly with acid

(61) **Rodman loamy sand**
Rodman sandy loam
" " " , gravelly phase
Rodman fine sandy loam

(Occurrence: along sides of valleys of upper Housatonic River and its tributaries in the limestone section)

(d) *Surface soil*: medium to light brown, with slight reddish cast; mellow to friable; slightly to excessively gravelly or sandy
Subsoil: reddish to pinkish yellow-brown; firm
Substratum at 24-30 inches—brownish red to pinkish gray; gravelly or sandy; composed of water-deposited sandstone, shale and traprock material

(62) **Manchester loamy sand**
Manchester loamy fine sand
Manchester sandy loam
" " " , gravelly phase
Manchester fine sandy loam
" " " " , gravelly phase
Manchester loam

(Occurrence: widely distributed in considerable area along valleys and in broader belts adjacent to Upland in Central Lowland)

(e) *Surface soil*: medium brown; mellow; moderately to excessively gravelly or sandy
Subsoil: yellow-brown, with slight pinkish cast; firm
Substratum at 24-30 inches—brownish gray, with slight reddish or pinkish cast; gravelly or sandy; composed of a mixture of water deposited Triassic (red) sandstone and conglomerate, gneiss and schist

(59) **Hampden loamy sand**
Hampden sandy loam
" " " , gravelly phase
Hampden fine sandy loam
" " " " , gravelly phase

(Occurrence: along valley sides of streams emerging from Eastern and Western Highland upon the Central Lowland; best developed in Somers, Granby and Bristol)

2—Topography: level to undulating terraces, usually with abrupt escarpments along streamward edge; no boulders; more or less gravelly or sandy

(a) *Surface soil:* medium to dark brown; mellow to friable; slightly to very gravelly
Subsoil: yellow-brown, becoming a lighter yellow with depth; firm
Substratum at 24-30 inches—gray to brownish gray; very sandy or gravelly; composed of water-deposited granite gneiss and schist material

(70) **Merrimac loamy coarse sand**
Merrimac loamy sand
Merrimac loamy fine sand
Merrimac sandy loam
" " " , gravelly phase
Merrimac fine sandy loam
" " " " , gravelly phase
Merrimac loam
" " , gravelly phase

(Occurrence: as terraces along larger streams of both Eastern and Western Highland and adjacent to the Connecticut River flood plain, where the largest areas are developed)

(b) *Surface soil:* medium to light brown; mellow; slightly to moderately gravelly
Subsoil: yellow-brown, with slight red-orange cast; firm
Substratum at 24-30 inches—olive-drab to bluish olive; gravelly, gravel chiefly disc-like in shape; composed of water-deposited phyllite or slate material

(72) **Fairlea fine sandy loam**
" " " " , gravelly phase
Fairlea very fine sandy loam

(Occurrence: as terraces along streams in Woodbridge, Orange and Milford, adjacent to Hollis soils)

(c) *Surface soil*: medium gray-brown to olive-brown; mellow to friable; slightly to moderately gravelly
Subsoil: pale yellow-brown to yellowish olive; firm
Substratum at 24-30 inches—grayish olive to light grayish brown; gravelly or sandy, gravel chiefly disc-like in shape: composed of water-deposited argillaceous schist

(71) **Sheffield fine sandy loam**
Sheffield loam

(Occurrence: occasional as terraces along upper Housatonic River and its tributaries, adjacent to Dutchess soils)

(d) *Surface soil:* medium brown; mellow; slightly to moderately gravelly
Subsoil: yellow-brown; firm
Substratum at 24-30 inches—light gray to olive gray; gravelly or sandy; sandy material effervesces with acid; composed of a mixture of water-deposited limestone, schist and quartzite material

(73) **Palmyra sandy loam,** gravelly phase
Palmyra fine sandy loam
" " " " , gravelly phase

(Occurrence: occasional as terraces along upper Housatonic River and its tributaries, adjacent to Dover, Pittsfield and other partially calcareous glacial till soils)

(e) *Surface soil*: medium to dark brown, with a definite reddish cast; friable; moderately to considerably gravelly
Subsoil: reddish yellow-brown to yellow-brown with slight reddish or pinkish cast; firm
Substratum at 24-30 inches—grayish red to reddish gray; usually very gravelly; occasionally sandy with little gravel; composed of water-deposited red (Triassic) sandstone, shale and traprock material

(74) **Hartford sandy loam**
" " " , gravelly phase
Hartford fine sandy loam
" " " " , gravelly phase
Hartford loam

(Occurrence: as terraces along streams in the Central Lowland; adjacent to Wethersfield, Cheshire and Manchester soils)

(f) *Surface soil*: medium to dark brown, with very slight reddish cast; mellow to friable; moderately to very gravelly
Subsoil: light yellow-brown, with slight pinkish cast at lower depths; firm to friable
Substratum at 24-30 inches—light brownish gray, with pinkish or reddish cast; very gravelly; composed of a mixture of water-deposited coarse Triassic sandstone, sandstone conglomerate and granitic material

(68) **Chicopee sandy loam**
" " " , gravelly phase
Chicopee fine sandy loam
" " " " , gravelly phase

(Occurrence: as terraces along streams emerging from Highland onto the Central Lowland, as in upper Scantic Valley in Tolland County)

(g) *Surface soil*: medium to dark brown, with slight grayish cast; mellow; very little gravel of coarser grades
Subsoil: pale yellow-brown; firm to friable
Substratum at 24-28 inches—gray to olive-gray; firm; sandy; composed of water-deposited sediments of crystalline rock material

(69) **Agawam sandy loam**
Agawam fine sandy loam
Agawam very fine sandy loam

(Occurrence: as lower terraces along the Connecticut River, at first level above the present flood plain; probably represents a post-glacial, but not recent, alluvial soil)

B. Fair to poor drainage; sandy parent material
1—Topography: level to undulating, usually as slight depressions on terraces or near higher land from which there is considerable seepage
(a) *Surface soil:* dark to very dark grayish brown to gray-black; mellow to friable
Subsoil: grayish yellow, mottled with gray and rusty brown; firm to compact; occasionally partially cemented as "iron-hardpan" at 20-24 inches
Substratum at 24-30 inches—light gray to bluish gray; compact; sandy or gravelly; composed of water-laid deposits of crystalline rock material; often underlain with compact heavy glacial till at relatively shallow depth

(75) **Scarboro sandy loam**
Scarboro loam

(Occurrence: as poorly drained areas associated with Merrimac, Hinckley and similar soils)

(b) *Surface soil*: dark grayish brown; friable to firm
Subsoil: reddish yellow-brown, mottled with gray and rusty brown; firm to compact

Substratum at 24-30 inches—pinkish or reddish gray; compact; sandy or gravelly; composed of water-laid deposits of red (Triassic) sandstone material

(76) **Ellington sandy loam**
Ellington loam

(Occurrence: as poorly drained low terraces, associated with Hartford soils)

C. Fair to poor drainage; heavy parent material

1—Topography: flat to undulating; occasionally steep where streams have cut their valleys or ravines through clay beds

(a) *Surface soil*: light gray-brown to grayish drab; friable to firm; no coarse sand or gravel
Subsoil: olive-drab, slightly mottled at 18-24 inches; firm to moderately compact
Substratum at 24-28 inches—olive-drab; compact, composed of stratified clay (laminated with silty layers) derived from crystalline rock sediments

(77) **Suffield very fine sandy loam**
Suffield silt loam
Suffield clay loam

(Occurrence: in Hartford County, in "valley" towns north of Rocky Hill)

(b) *Surface soil:* dark grayish brown to gray-black; friable to firm; no coarse sand or gravel
Subsoil: mottled drab gray, yellow and rusty brown; compact; heavy
Substratum at 24-28 inches—light olive-drab; compact; composed of stratified clay (laminated with silty layers) derived from crystalline rock sediments

(79) **Scantic loam**
Scantic clay loam

(Occurrence: in Hartford County, in wetter areas associated with Suffield soils)

(c) *Surface soil*: medium to dark grayish brown, with reddish cast; friable to firm; no coarse sand or gravel
Subsoil: yellowish red-brown; firm to compact
Substratum at 24-30 inches—red-brown; compact; composed of stratified clay (laminated with silty layers) derived from red (Triassic) shale sediments

(78) **Berlin silt loam**
Berlin clay loam

(Occurrence: chiefly in towns of Berlin, Middletown and North Haven)

III. SOILS DEVELOPED FROM MATERIAL OF WIND-DEPOSITED ORIGIN

A. Well to excessively drained

1—Topography: irregular, with characteristic dunes, usually from 2 to 10 feet high. Composed of fairly coarse-grained sandy material. Dunes normally stabilized, with soil profile development

(a) *Surface soil:* medium to light brown; mellow; very sandy, no coarse gravel

Subsoil: yellow-brown, becoming paler with depth; mellow to firm

Substratum at 20-30 inches—light, brownish gray, incoherent sand, composed of only slightly weathered crystalline material, containing considerable quartz

(67) **Windsor loamy coarse sand**
Windsor loamy sand
Windsor loamy fine sand
Windsor fine sandy loam

(Occurrence: chiefly associated with the larger terraces of Merrimac soils, in Hartford County)

2—Topography: undulating to rolling (2-15 percent) slope. Soil material of a fine-textured sand deposited as a mantle 2 to 4 feet thick over underlying gravelly glacial outwash or sandy till

(a) *Surface soil:* light to medium brown, with a slight yellowish cast; very mellow; no gravel or stone under natural conditions

Subsoil: light yellow-brown, grading to olive-gray with depth; friable

Substratum at 24-30 inches—light olive-gray to brownish gray; fine sand, very uniform in texture; composed of wind deposits derived from crystalline material; overlies reddish colored gravel or sandy till at variable depth, usually less than 48 inches from surface

(In the "shallow phase" the lower subsoil and substratum have characteristics identical to the Cheshire series)

(65) **Enfield fine sandy loam**
" " " " , shallow phase
Enfield very fine sandy loam
" " " " " , shallow phase

B. Fair to good surface drainage; impeded underdrainage

1—Topography: level to slightly undulating. Soil material a fine-textured sand deposited upon stratified clay

(a) *Surface soil:* medium to dark grayish brown; mellow; no gravel or coarse sand

Subsoil: grayish yellow-brown to grayish olive-brown; friable to firm

Substratum at 24-30 inches—olive-gray, mottled with yellow and rusty brown; moderately compact; fine sand, of uniform grain size; composed of wind deposited crystalline material; overlies drab-colored stratified clay (laminated with silt) at variable depth, usually at from 36 to 60 inches below the surface

(66) **Melrose very fine sandy loam**
Melrose loam

(Occurrence: associated with Enfield soils on higher ground and Suffield soils in adjacent lower-lying areas)

IV. BOTTOM-LAND SOILS DEVELOPED FROM RECENT ALLUVIAL MATERIAL

A. Good surface drainage and unimpeded underdrainage

1—Topography: level, usually at a few feet elevation from lowest portion of flood plain

(a) *Surface soil*: medium brown; mellow; little or no gravel
Subsoil: yellow-brown; friable
Substratum at 24-30 inches—brownish gray to yellowish gray; sandy or fine gravelly; composed of water-deposited material derived from crystalline rocks

(80) **Ondowa sandy loam**
Ondowa fine sandy loam
Ondowa silt loam

(Occurrence: on well-drained, rarely inundated portion of flood plains of larger streams, such as the Connecticut River)

B. Fair to poor drainage, with permanent water table within a few feet of the surface.

1—Topography: level to slightly undulating, frequently with depressions along old channel courses

(a) *Surface soil*: medium to dark gray-brown; mellow to firm; occasionally gravelly in old channel courses
Subsoil: dark gray to grayish brown; variable in texture and roughly stratified
Substratum at variable depth—light gray to gray-brown sand or fine gravel, roughly stratified; composed of deposits derived from crystalline rocks

(81) **Podunk sand**
Podunk loamy sand
Podunk loamy fine sand
Podunk sandy loam
Podunk fine sandy loam
Podunk silt loam
Podunk silty clay loam

(Occurrence: as bottom land along streams in Eastern and Western Highland and on the Connecticut River flood plain)

(b) *Surface soil:* dark olive-brown; mellow; no gravel or coarse sand
Subsoil: yellowish olive, becoming mottled with yellow and rusty brown at lower depth; firm
Sustratum: drab to bluish gray; heavy; compact; composed of sediments derived from argillaceous schist material

(82) **Saco loam**
Saco silty clay loam

(Occurrence: on flood plain of upper Housatonic River and its tributaries, chiefly in Canaan, Salisbury and Sharon)

(c) *Surface soil*: dark brown with reddish cast; friable to firm; rarely gravelly
Subsoil: red-brown to light pinkish brown; firm; roughly stratified with pinkish gray sand
Substratum: light brownish red to pinkish gray; roughly stratified and variable in texture; composed of sediments derived chiefly from red (Triassic) sandstones and shales

(83) **Middlefield fine sandy loam**
Middlefield loam
Middlefield clay loam

(Distribution on flood plains of streams with drainage basins in areas of Wethersfield, Cheshire and similar soils)

V. ORGANIC SOILS

A. Very poor drainage; water table at or near the surface at all times

1—Topography: depressions with drainage outlets partially or completely blocked

(a) Organic material: brown; fibrous; little or no inorganic material of earthy character; composed of residues from sphagnum, sedges and woody plants; depth to mineral substratum usually 20 feet or more, except at swamp margin

(93) **Peat**

(Occurrence: scattered in many parts of State; most common in Western Highland)

(b) Organic material: very dark brown to black; mellow, well disintegrated; often more or less mixed with earthy material of alluvial deposition; composed of residues from woody and herbaceous plants, rushes and sedges; depth to mineral substratum varying from less than 3 feet in the "shallow phase" to 40 feet or more; substratum—light bluish gray in color; silty

(92) **Muck**
(91) **Muck,** shallow phase

(Occurrence: in areas ranging from less than an acre to more than one square mile, in all parts of the State; largest units in southeastern Connecticut)

2—Topography: flat, on margins of tidal inlets along Long Island Sound and near the mouth of the larger streams entering it

(a) Dark gray, gray-brown to gray-black; firm; considerably mixed with silty sediments of alluvial origin; frequently somewhat peaty and fibrous from the decomposing mat of salt marsh sedges and rushes; less peaty and more compact at lower depths; occasionally roughly stratified with sand originating from old channel courses; very high in salt content, as a result of periodic inundation with sea water

(94) **Tidal Marsh**

(Occurrence: extensive in the "shore" towns)

VI. MISCELLANEOUS LAND AREAS WITH NO DEFINITE SOIL CHARACTERISTICS

A. Varied drainage conditions; not differentiated

1—Topography: hilly to mountainous

(a) Surface almost entirely paved with loose boulders, with more or less bedrock outcrop; soil chiefly similar to Gloucester stony, fine sandy loam in characteristics, but often of other types, not readily distinguished

(95) **Rough stony land**

(Occurrence: extensive in rougher, wooded areas in Eastern and Western Highland, and along the traprock ranges rising from the Central Lowland)

(b) Exposures of solid rock, in place, with little or no soil covering

(96) **Rock outcrop**

(Occurrence: in rougher areas of broken topography in highlands and along the faces of the traprock ranges)

2—Normal topography disturbed as a result of man-made excavation or fill

(a) Areas excavated in the removal of sand or gravel

(99) **Gravel bank**

(Occurrence: coincident with distribution of soils of Group IIA)

(b) Areas excavated for removal of clay

Clay pit (when abandoned, usually occupied by ponds)

(Occurrence: coincident with distribution of Suffield and Berlin Series)

(c) Areas excavated for removal of rock

Quarry

(Occurrence: chiefly in areas of soils of Group I)

(d) Areas filled for land development

(98) **Made land**

(Occurrence: chiefly in or near the larger cities)

3—Miscellaneous deposits of natural origin

(a) Clean, loose sand fringing exposed shores of Long Island Sound, swept by waves, tide and wind

(97) **Coastal beach**

(b) Sand and gravel areas adjacent to rapidly flowing streams, washed clean of soil by strong channel currents during flood periods

River wash

INTERRELATION OF SOIL SERIES

The numerous soil series described in the key presented in previous pages are chiefly the result of the operation of comparatively uniform climatic forces upon soils modified by differences in parent material and drainage conditions. The interrelation of various soil series with respect to these factors is shown in Table 3.

TABLE 3. LITHOLOGIC AND DRAINAGE RELATIONSHIPS OF CONNECTICUT SOILS

	DRAINAGE CONDITIONS					
	Perfect to excessive	Good	Fair		Poor	
	Little or no compactness in substratum	Moderate compactness in substratum	Very compact substratum	Very compact substratum	Seepage	Poor surface drainage
Glacial morainic deposits from						
Non-calcareous, crystalline rocks	**Plymouth**					
Glacial till deposits (unstratified) from						
Non-calcareous, crystalline rocks	**Gloucester** **Hermon***	**Essex**	**Woodbridge**		**Peru**	
Gneiss and schist:						
Quartzite and quartz schist	**Coloma**	**Charlton**	**Taugwank**	**Sutton**		
Mica schist, ferruginous	**Brookfield**		**Paxton**			
Diorite and dioritic schist	**Wilton**					**Whitman**
Granite and granite gneiss	**Hinsdale**	**Haddam**				
Chlorite and chlorite schist	**Maltby**					
Phyllite or slate	**Hollis**	**Bernardston**				
Shaly schists	**Dutchess**	**Litchfield** **Becket***				
Calcareous rocks:						
Limestone or dolomite	**Dover**					
Limestone or dolomite mixed with schist	**Pittsfield**	**Lenox**	**Stockbridge**			**Lyons**
Triassic rocks:						
Red sandstones, and shales	**Cheshire**	**Wethersfield**			**Whippany**	
Trap rock	**Holyoke**					**Whitfield**
Mixed sandstone, conglomerate and crystalline rocks	**Middletown**					
Trap rock mixed with sandstone and shale	**Southington**					

*Well podsolized under natural forest conditions.

TABLE 3.—Continued

	DRAINAGE CONDITIONS			
	Perfect to excessive		Slow to poor	
	Uneven topography knolls and low rounded hills	Level terrace land	Level terrace land	Clay flats and clay banks
Stratified glacial drift (water deposited) from				
Non-calcareous, crystalline rocks:				
Mixed gneiss, schist, granite, etc.	**Hinckley**	**Merrimac** **Agawam***	**Scarboro**	**Suffield**
Phyllite and chlorite	**Hancock**	**Fairlea**		
Shaly schists, occasionally some limestone influence		**Sheffield**		
Calcareous rocks:				
Limestone and dolomite, mixed with schist, gneiss, etc.	**Rodman**	**Palmyra**		
Triassic rocks:				
Red sandstones, shales and trap	**Manchester**	**Hartford**	**Ellington**	**Berlin**
Mixed Triassic and crystalline	**Hampden**	**Chicopee**		
Wind-deposited drift, from				
Non-calcareous, crystalline rocks	**Enfield**		**Melrose**	

	DRAINAGE CONDITIONS	
	Perfect to excessive	Slow to poor
Recent alluvial material, formed from		
Non-calcareous crystalline rocks:		
Mixed gneiss, schist, granite, etc.	**Ondowa**	**Podunk**
Shaly schists		**Saco**
Triassic rocks		**Middlefield**

*Probably represents a post-glacial, but ancient, alluvial soil.

LAND TYPES

The soil classification given in the preceding pages is based primarily on morphological characteristics by which individual soils may be recognized. Many of these differences in soils are of little or no significance in measuring the suitability of a given area for cropping, grazing, forestry or other land use. Furthermore, it is obvious that the land-use pattern in any given locality must cut across boundaries between many of the soil types. The agricultural scene is much less diverse than the detailed soil map would indicate. Recognition of every apparent variation in color, texture and parent material in soil type differentiation is quite sound if soil taxonomy is to be a true branch of soil science. However, there is need of a grouping based on soil qualities that have a definite relationship to the utility of the land.

It is also necessary to recognize the modifying effect of man's handiwork, especially in a region like southern New England where the land has been subject to clearing, removal of stone, cultural improvement, and depletion by cropping and erosion for from two to three centuries. A high degree of selection has been attained. Many areas formerly cultivated, but found to be of little crop value, have been abandoned to woodland or brush pasture. The better soils have remained in crop production for the most part. It can be said with reasonable certainty that not more than 10 percent of the present area now in woodland is potential crop land. This is probably counterbalanced by a corresponding area that will be gradually dropped from cultural use as entirely unsuited to contribute to the support of a farm population.

A considerable area of soil of a fair degree of productivity occurs in small, isolated patches of only a few acres, interspersed over a general region where the land is too stony, thin, sandy, wet or otherwise unsuitable for farming. Except for the development of part-time agriculture in Connecticut, greatly promoted in recent years by rapid expansion of transportation facilities, these islands of suitable soil would be too small to support a farm family, and would suffer land abandonment. In many cases previously abandoned farms have been restored as country homes by persons in economic classes ranging from the mill laborer to the Wall Street banker. Brush-grown fields have been used to supply feed for the family cow or poultry flock, or converted into home gardens or the well-kept grounds of an estate.

On the other hand, farming as the sole source of livelihood is now chiefly confined to the larger areas of more favorable soils. In a few sections, especially in the southwestern and northeastern corners of the State, considerable areas of good land are in large country estates, with little productive utilization.

The characteristics of land with respect to soil and other factors influencing its potential agricultural utilization have been grouped into a number of categories designated as Land Types. In the sense used in this bulletin, the term "land type" applies to the features of a definable area of land with respect to its characteristic pattern of soil, relief, erosiveness, stoniness and drainage under the prevailing climatic features of the region. It is not based on its present or potential use or upon economic land value. The features thus identifying land types are basic to land use adjustments and economic land classification when considered in relation to markets, transportation, population and related economic and social factors.

The land types represented in Connecticut are described in the following pages, and their distribution is indicated on the accompanying maps.

Land Types generally unsuitable for crop production:

XX—Mountainous, excessively hilly or stony land. Such areas are entirely unsuited to farming, and are valuable only for forestry or recreational uses. This type occurs most generally in the Western Highland from New Milford and Beacon Falls northward, although it is frequently found also in southeastern Connecticut and on the precipitous trap-rock ranges that rise from the Central Lowland. No soil differentiation within this type has been made.

FIGURE 4. Low grade pasture and woodland on Land Type X.

X—Stony, moderately rough, hilly land, predominantly of lighter, drier upland soils. Stony phases of the Gloucester, Brookfield and similar series are representative. Most of the area is in woodland, although as mapped, it includes considerable pasture of low grade and many small. isolated blocks of farm land.

X_k and X_c—Land of above characteristics, influenced to a greater (X_k) or less (X_c) degree by limestone in the parent material. Stony phases of the Dover and related series are representative.

X_t—Land of "X" characteristics except that the soils are formed from the Triassic rocks of the Central Lowland or from the associated trap-rock formation, and are modified by their distinctive features. Stony phases of the Holyoke, Cheshire and related series are representative of this sub-type.

X_j—Land of "X" characteristics except that the underlying material is loose and very coarse gravel. Certain rugged areas of Hinckley and related series are representative.

A—Stony, moderately rough to rolling hill land predominantly of soils having loamy texture and favorable moisture characteristics. Stony phases of the Charlton, Woodbridge and similar series are representative. Although the major portion of the area is in woodland, the better moisture conditions and generally less rugged topography favor a greater use as pasture than on "X". Scattered fields of land chiefly used for grass hay are included in the type as mapped.

FIGURE 5. Good pasture turf on Land Type A. Note hay crop in rotation on Land Type E, left background.

A_k and A_c—Land of "A" characteristics, except that the soils are influenced to a greater (A_k) or less (A_c) degree by limestone in the parent material resulting in a less acid condition. Stony phases of the Pittsfield, Lenox and related series are representative.

A_t—Land of "A" characteristics, except that the soils are formed from the Triassic rocks of the Central Lowland, or from the associated trap-rock formations, and are modified by their distinctive features. Stony phases of the Wethersfield and more loamy types of the Cheshire, Holyoke and similar series are representative.

B—Excessively sandy, "droughty" land, predominantly of soils made up almost entirely of coarse deep sand, with very deficient moisture capacity. The loamy coarse sand types of the Merrimac, Hinckley, Hartford and similar series are representative. The area is typical "sand plain" land, supporting a scrubby growth of pitch pine, scrub oak and low-bush blueberries. Many open areas are covered with broom-sedge and frequently the surface is entirely barren.

A number of large areas of this type in Hartford County, chiefly in the towns of Windsor Locks, East Granby, Bloomfield and Windsor, have been successfully used for growing tobacco under shade. The artificial conditions of air humidity afforded by the tents make such cropping possible in favorable seasons, and while yield is light, the superior quality of the thin leaf thus produced gives profitable returns from the exceptionally heavy fertilizer application needed on land of this type.

FIGURE 6. Barren, wind-eroded area on Land Type B.

C—Poorly drained, excessively wet land, predominantly of organic soils designated as muck (well-decomposed organic deposits usually containing some matter of mineral origin) or peat (poorly decomposed fibrous organic deposits containing little or no material of mineral origin). Such areas occur in topographic depressions with impeded drainage outlet. In most cases artificial drainage is impractical and the land is left to its natural swamp forest growth of red maple and alder or white cedar. Some rush marshes occur, chiefly adjacent to sluggish streams.

A few generations ago much humus material from such areas was used on poor sandy soils as a soil amendment to increase their moisture capacity. The practice is now being revived in some localities, chiefly for ornamental horticulture and lawn improvement.

In addition to areas mapped as "C", most other land types include a small proportion of poorly drained soils. In most cases these are of similar origin to the better-drained lands with which they are associated, and are modified as a result of high water table resulting

from side-hill seepage, impervious substratum, or low topographic location. The Peru, Whitman, Whippany, Lyons and Scarboro series are representative, and portions of many cultivated fields require special attention to drainage as a consequence of their widespread occurrence. However, it has not been practicable to differentiate land of this type on maps of the scale published with this bulletin.

FIGURE 7. Swamp woodland on Land Type C. Red maple with alder.

C_s—Land of "C" characteristics, except that the area is periodically inundated by saline tidal water from Long Island Sound. These tidal marshes are covered with a natural carpet of "salt grass" vegetation which is often harvested as hay for bedding, packing material, mulching, etc. When the marshes are partially protected from flooding by tide gates and sea walls, the meadows become infested with undesirable weedy species. Some areas might ultimately be reclaimed for agricultural use, as has been done in Holland, if land needs were to become acute. In Connecticut it is more probable that they will be artificially built up to a higher level to provide sites for shore recreational development, factories, landing fields, etc.

Land Types Generally Suitable for Crop Production:

D—Moderately to slightly stony hilly land of lighter, drier upland soils. Slopes are irregular, ranging from 5 percent to 25 percent. Bedrock is only a few feet below the surface, and outcrops are frequent. Drainage is rapid, as a consequence of the surface features and pervious character of the unweathered glacial deposits immediately under the subsoil. Most types of the Gloucester, Brookfield, Hinsdale and similar series are representative. Their greatest distribution is in eastern Connecticut and in the eastern and southern portion of the Western Highland.

The organic content of the upper soil is moderately favorable, ranging from 3 percent to 5 percent, and under average conditions of culture for this type, it is readily maintained. However, under more intensive cultivation, it is desirable to grow green manure crops and to plow under a growth of sod every three or four years, in addition to the use of manure.

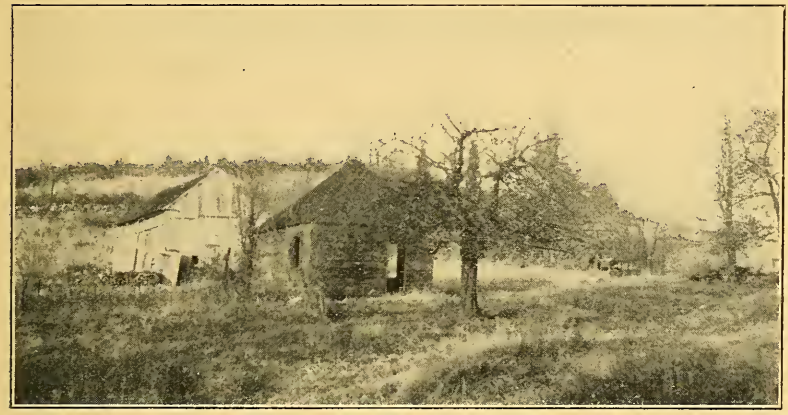


FIGURE 8. Abandoned farmstead on Land Type D.

The soils are naturally strongly acid and of low available chemical fertility, particularly with respect to phosphorus. If surface features and degree of stoniness permit, the land is capable of being brought to a high state of fertility. As a rule, from two to three tons of limestone per acre must be applied in order to grow crops that are exacting in their lime needs. Field crops do best on manured land, in connection with supplemental applications of superphosphate. Intensive culture, as in the growing of vegetables and potatoes, involves the use of liberal amounts (up to one ton per acre) of a well balanced complete fertilizer, such as the 5-10-5 or 5-8-7.

Important limiting factors in land of this type are as follows: The small size of arable units; the irregularity of surface; the degree of stoniness; the leachy character of the soil; and the poor adaptation for grass hay and pasture. As a consequence, except under special situations, farming on a productive commercial scale is rarely developed. Part-time farming is very common, especially in eastern Connecticut. Small dairy farms are the rule. In some sections there is considerable vegetable production, especially in Shelton and Brooklyn. Orcharding is occasionally developed on a commercial scale, although units are usually small and widely scattered in occurrence. Poultry raising is not greatly affected by the limitations of such land, and is frequently practiced. No tobacco is grown on land of this type.

D_k—Land of above characteristics, influenced to a considerable degree by limestone in the parent material. The soils are only slightly acid to neutral in reaction, and are often less deficient in available phosphorus

than the "D" soils derived from granite, gneiss and schist rocks. As a consequence, there is a somewhat more favorable condition with respect to pasture and the growth of legumes.

The Dover series is representative. Such land occurs in the rougher portions of the limestone valleys in Sharon, Salisbury, Canaan and other towns from Ridgefield northward.

D_t—Land of "D" characteristics, except that the soils are formed from the Triassic rocks of the Central Lowland, or from associated trap-rock formations. The lighter types of the Cheshire, Middletown, and Holyoke series are representative. The land qualities are not significantly different from the "D" areas in the Eastern and Western Highlands.

E—Moderately to slightly stony, hilly land of medium-textured soils with good, but not excessive, drainage. The hills are moderately well-rounded with prevailing slopes from 3 percent to 20 percent. Bedrock is normally several feet below the surface, although rock outcrops are not uncommon. Surface drainage is good, and underdrainage is favorable, but less rapid than on the "D" type. The underlying glacial deposits are firm to moderately compact in character. The lighter types of Charlton, Woodbridge and similar series, as well as the more loamy types of Brookfield, Wilton and similar series, are representative. Their distribution is fairly general in both the Eastern and Western Highlands. Areas are most frequently in close proximity to "F" land from which it is frequently difficult to distinguish without careful study of the texture and underdrainage characteristics.

The organic content of the upper soil is usually favorable, ranging from 3.5 percent to 6 percent, and under average conditions of culture it is readily maintained. Under intensive cultivation, as in the growth of vegetables and potatoes, it is desirable to plow under a growth of sod once every few years.

The soils are naturally strongly acid, and of low available fertility. However, such land has usually been better farmed than the type "D" and less drastic measures to maintain chemical fertility are required. On the other hand, the more favorable moisture conditions have encouraged farmers to leave the land in grass for long periods with consequent gradual deterioration of yields. Top-dressing of hay fields with fertilizers high in nitrogen is a practice that should be more general. For most crops, lime and fertilizer practices indicated for "D" should result in profitable yields. Such land has a wide degree of crop adaptation, and unless the slope is excessive (15 percent or more) and the soil is unusually stony, most crops climatically adapted to the region may be grown successfully.

Dairy farming is important on this type since the land is well suited to the growth of all feed crops and fair pasture is afforded by such land, as well as by associated "A" areas usually adjacent on the stonier and rougher soils. The soil is especially suitable for fruit, particularly apples and peaches. Summer vegetables, such as sweet corn, tomatoes, cabbage, brussels sprouts, summer squash and cucumbers, are somewhat better adapted than the early vegetables, since the land is somewhat later in characteristics than the lighter soils. Potatoes are being

grown to an increasing degree. Tobacco is produced in some areas, especially on the sub-type "E_t", within the tobacco district, although acreages have decreased greatly in recent years.

E_k and E_c—Land of above characteristics, except for being influenced to a greater (E_k) or less (E_c) degree by limestone in the parent material. The consequent decreased acidity of the soil gives a somewhat better natural productivity, especially for legumes and pastures.

E_t—Land of "E" characteristics, except that the soils are formed from the Triassic rocks of the Central Lowland, or from the associated trap-rock formations. Medium-textured types of the Cheshire, Wethersfield and Holyoke series are representative. Land of this sub-type has a somewhat greater range of crop adaptation than the "E" areas of the Eastern and Western Highland, and in general, crop production is more intensive. Orcharding is especially favored, and the greatest development of this type of farming is reached in Wallingford, Cheshire, Southington, Middlefield and adjacent towns.

FIGURE 9. Commercial orchard, hay and pasture on Land Type E_t.

F—Moderately to slightly stony, hilly land of loamy soils with somewhat imperfect underdrainage. The land surface is well rounded, with moderate slopes, ranging from 3 percent to 15 percent. Bedrock is deep and rock outcrops rarely occur. Surface drainage is usually adequate, but the compact character of the underlying glacial deposits impedes the downward movement of water after rains and spring thaws. Consequently the soil is often too wet to work early in the spring and after periods of heavy rainfall. Seepage from lower slopes produces frequent small areas that are difficult to cultivate. The heavier types of Charlton, Woodbridge and similar series are representative. Their greatest distribution is in eastern Connecticut from Lebanon north-

ward, and in the central and northern portion of the Western Highland. However, isolated ridges of such land are found in most of the highland towns.

The organic content of the upper soil is quite favorable, ranging from 4 percent to 7 percent, and is rarely a problem to maintain. The land is usually in grass for several years, and the depletion of humus suffered while under cultivation is rapidly rectified.

The soils are naturally acid and of fairly low available chemical fertility. However, a number of fields maintain fair yields of grass hay for many years with little treatment except for occasional light dressings with manure. A more general use of fertilizers and lime would increase their productivity. Fields planted to corn for silage and grain are usually well manured. Superphosphate usually gives good response, and complete fertilizers applied to hill or row are important in promoting earlier maturing corn for grain.

FIGURE 10. Grass hay on Land Type F.

Land of this type is preëminently adapted to dairy feed crops. However, many soils are likely to cause considerable winter-killing of alfalfa, a legume now becoming increasingly important on dairy farms. Very good pastures are easily obtained, especially where the fields receive applications of limestone and superphosphate. Orcharding is often practiced, but careful attention must be given to the selection of sites, to avoid areas with especially compact hardpan near the surface. The land is better adapted to apples and pears than to peaches. Most areas are poorly suited to early vegetable crops and are less valuable for potatoes and summer vegetables than the medium-textured "E" type.

F_c—Land of above characteristics except that it is influenced to a considerable degree by limestone in the parent material. Some acidity occurs in the surface soil and upper subsoil, but, in general, the land is natur-

ally more fertile than on the "F" type. The Stockbridge series is representative, and has a limited occurrence in well-rounded ridges rising from the limestone valleys of northwestern Connecticut.

F_t—Land of above characteristics except that the soils are formed from the Triassic rocks of the Central Lowland. The heavier types of the Wethersfield and Cheshire series are representative. These are well distributed over the well-rounded ridges rising in many parts of the Central Lowland, especially in southern Hartford, northern New Haven and northwestern Middlesex counties. The land is somewhat more perfectly drained than the "F" soils of the Eastern and Western Highlands and is somewhat wider in its degree of adaptation. However, it is also chiefly valuable for dairying, and the most extensive development of this type of farming occurs on such land.

G—Slightly stony to non-stony, rolling land of medium-textured soils with good but not excessive drainage. Slopes are moderate, ranging from 2 percent to 12 percent in most instances. The favorable topography and absence of boulders permit easy cultivation in large field units. The soil is retentive of moisture, but underdrainage is adequate for all crops. The Dutchess and Hollis series and more favorable areas of the Wilton series are representative. All are characterized by argillaceous shale, or slate, or dark-colored fissile schist fragments in the glacial deposits from which the soils are formed. Their distribution is confined to the Sharon Valley section of Sharon and Salisbury, the phyllite slate area in Milford and Orange, and the vicinity of Southport.

The organic content of the upper soil is naturally favorable, ranging from 3 percent to 5 percent. However, since the soil is more readily cultivated than other upland soils, special measures designed to maintain the humus content are often necessary. Cultivated crops should be rotated so as to provide a heavy turf to be plowed into the soil every three of four years. Green manure and cover crops are desirable, especially the latter, since land of this type is more easily eroded than most soils of the State.

The soils are naturally acid and of only moderately available chemical fertility. By the use of lime and fertilizers such land has often been built up to a more favorable degree of productivity than has been developed on the "D", "E" and "F" types.

Such land is especially adapted to the production of grain crops. In earlier periods much small grain was raised. At present corn for grain or seed is quite commonly grown, especially in the Milford area. Most vegetable crops do well, and the Southport section was formerly an important onion producing center. Potatoes are very well adapted to such land.

Large fields of suitable land for the production of feed crops have favored the development of large commercial dairies. While well suited to fruit, the superiority of this land for other crops has not encouraged the development of orcharding.

G_c—Land of above characteristics except that it is influenced to a considerable degree by limestone in the parent material. The smoother areas of the Lenox series are representative. They are confined to the north-

western corner of the State. Although requiring somewhat less lime to correct its acidity, the land is not recognizably different from the "G" type in the same section, characterized by the Dutchess soils.

G_t—Land of "G" characteristics except that the soils are formed from the Triassic rocks of the Central Lowland. The more favorable areas of the Wethersfield, Cheshire and Manchester series are representative soils. The adaptation and management of land of this sub-type are similar to those of "E_t". However, more uniformly favorable topography and greater freedom from stone have promoted the development of an especially intensive and varied agriculture. Dairy feed crops, orchard and small fruits, potatoes and vegetables of many sorts are all well represented.

G_e—Land of "G" characteristics distinguished by freedom from stone or gravel and exceptional mellowness and depth of soil. The Enfield series and associated areas of Manchester and Cheshire series with similar qualities are representative. Large contiguous blocks of this sub-type occur in eastern Hartford and western Tolland counties from Glastonbury north to Somers. It is distributed in more limited occurrence from Bloomfield and Windsor north to the state line, especially in the west-central part of Suffield. A few scattered areas have been identified elsewhere in the Triassic Lowland as far south as Cheshire.

The organic content of the upper soil is naturally somewhat lower than for other soils of the State, rarely exceeding 3 percent. Under the frequent cultivation favored by the ease of tillage, humus is difficult to maintain. This problem is closely related to the exceptional erosiveness, even on gentle slopes, unless protected by sod cover. Since the area is especially adapted to tilled crops and is not well suited to grass hay or pasture, a definite sacrifice of a portion of the land ordinarily devoted to cash crops is necessary in order to prevent serious erosion losses and depletion of organic matter. The federal soil erosion control projects in the Scantic River watershed should provide demonstrations of practical measures that may be taken to conserve this valuable land without unduly limiting its immediate crop returns.

Acidity and low natural chemical fertility are typical of the soils of this sub-type. The two most important crops of the major portion of the area are potatoes and tobacco. Disease control for both requires the maintenance of an acid reaction; hence lime is applied rather sparingly. On the other hand, a liberal yearly use of fertilizers has accomplished a very high degree of productivity.

Such land is also very well suited to vegetables, corn and legume hay. Cucumbers are an especially important vegetable crop. Orcharding has not been developed to any significant extent, although the soils appear to be reasonably favorable, particularly for peaches, grapes and other small fruits.

H_t—Level to gently rolling land entirely free from stone or coarse gravel, of light to medium texture, but of slow drainage resulting from underlying clay deposits. Surface drainage is usually adequate, although most fields contain spots requiring ditching or tiling if cultivated crops are to be grown successfully. The Melrose series and the lighter types of

the Suffield series are representative. These are distributed over considerable areas of Hartford County, north of Hartford and Glastonbury.

The organic content of the upper soil is quite variable, most fields showing pronounced areal differences in color from light gray-brown to nearly black, depending upon whether the original local drainage was good or poor. Special attention to maintaining soil humus is required on the lighter spots.

The soils are also quite variable in natural degree of acidity and available chemical fertility, but it is probable that the normal condition is somewhat more favorable in these respects than in other valley soils.

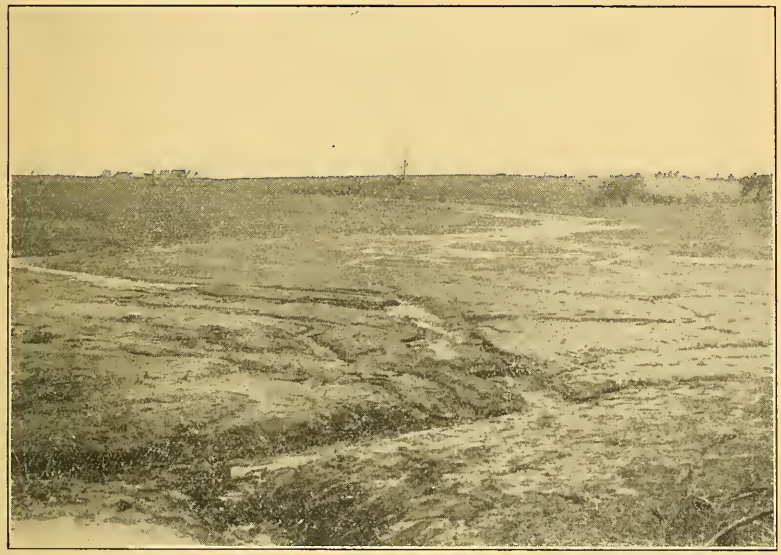


FIGURE 11. Severe erosion, destroying productive area of Land Type G_e.

Such land is especially well suited to vegetable crops, particularly to those requiring a light soil of good moisture capacity, such as onions, celery, cabbage and cauliflower. Some very good tobacco fields may be found on this type, especially in the Broadleaf district. However, the leaf is apt to be rather heavy unless the season is drier than usual. Potatoes do well when wet spots in the field are properly drained.

In general, there is a greater proportion of land in pasture and woodland than on the more perfectly drained, adjacent areas of types "G_e" and "K". Most uncultivated land contains an unusual proportion of poorly drained soils of the Scarboro and Ellington series.

In Berlin and neighboring towns the soil and underlying clay is more red in color resulting from a greater predominance of Triassic material in the sediments from which they are formed. These "H_t" areas are less used for crop production and are more commonly devoted to grass

hay and pasture. The lighter types of the Berlin series are the prevailing soils.

I_t—Valley land with soils of heavy texture and slow underdrainage resulting from underlying clay deposits. The topography is level to gently rolling except where ravines have cut back into the clay areas, in which case steep slopes are the rule. The clay loams and clays of the Suffield and Berlin series are representative. These occur in considerable areas in the upper Connecticut Valley towns from Hartford northward, particularly in Suffield, and are also distributed to a limited extent in Berlin, Newington, and adjacent towns. (There are clay beds of similar character in North Haven, but in this case they underlie extensive marshes of sub-type "C_s".)

Land of this type is too heavy for easy tillage, and is not adapted to the important cultivated crops of the region such as tobacco, potatoes and vegetables. In favorable seasons, when the rainfall is not excessive, during the spring and early summer corn can be grown successfully. When limed and fertilized, the land is excellent for grass hay and pasture. Pastures on the steeper ravine slopes are especially subject to erosion unless protected by a well-managed turf of good density. Since the soils are not tilled frequently, the normal organic content of 3 percent to 5 percent is adequate and presents no problem except on eroded land as noted above.

J—Land without large stones, of irregular surface, and of soils with rapid drainage features. The surface is characterized by a succession of hummocks and depressions, as a rule occurring at about the same general level along the lower valley slopes or occasionally in the vicinity of drainage divides. The underlying material ranges from fine sand to very coarse gravel, and is irregularly stratified.

As a rule, the soil contains much gravel, particularly on the hummock crests. Most soils of the Hinckley series are representative. These are widely distributed throughout most of the valleys of both the Eastern and Western Highlands, particularly in the eastern section.

The native organic content of the upper soil usually is favorable, ranging from 3 percent to 5 percent. Under frequent tillage it is rapidly depleted and requires a combination of liberal manuring and the plowing under of sod and green manure crops to maintain a sufficient humus level to offset partially the leachy, droughty characteristics of such land.

Acidity and natural chemical fertility are closely similar to those of the "D" type with which it is most commonly associated. The "J" areas are utilized for tilled crops to an important degree, especially in the southeastern Connecticut towns since most other land in the localities where they commonly occur is usually quite stony and rough. Small dairy farms are the rule, with the "J" land used for corn silage, followed by grass hay of rather poor quality and yield except for the first year or two after manuring. Cleared areas of adjacent stony lands of the "X" type provide pasture if the acreage per cow is sufficiently large. Where the topography is not too irregular and on the less gravelly soils, many small fields are available for the production of intensively

cultivated crops such as vegetables and potatoes. Units of suitable soils are rarely of sufficient size to favor such farming on a commercial scale except in isolated instances.

Land of this type is well adapted to part-time farming. The local diversity of soil provides small plots suitable for a variety of crops. The areas are most commonly distributed in narrow belts along improved highways.

The more gravelly or inaccessible areas are often in woodland and are most commonly occupied by a growth of old-field white or pitch pine more or less mixed with hardwoods. Considerable areas have been planted to white or red pine.

FIGURE 12. Worthless growth of broomsedge (*Andropogon soparius*) on gravelly knoll, Land Type J. Note rounded cobbles in stone wall.

J_c—Land of the above characteristics except that it is influenced to a degree by some limestone in the material composing the sand and gravel deposits. However, the leachy character of the soil has resulted in a generally acid condition of the upper soil. Soils of the Rodman series are representative. These are distributed along the upper Housatonic River and tributary streams in the limestone section. Since the adjacent uplands are apt to be of types favorable for farming, this subtype is utilized to a less extent than the "J" areas. However, it is somewhat more valuable for grazing and is used considerably for that purpose. A distinctive feature is the prevalence of scattered red cedar trees in such pasture lands.

J_t—Land of "J" characteristics except that the sand and gravel deposits from which the soils are formed contain a predominance of material derived from the Triassic rocks of the Central Lowland, or from the associated trap-rock formations. The more gravelly and sandy types of the Manchester and Hampden series are representative. In general the soils are somewhat less sterile than the "J" land of the Eastern

and Western Highland. However, they are used for farming to only a limited extent since they are less desirable than the associated upland soils and other valley types. To an even greater extent than in the case of the "J" areas, much of the land is occupied by cities, towns and villages.

K—Level to undulating valley terrace land of moderately sandy soils developed over deep strata of sand and fine gravel. Underdrainage is rapid but not excessive in normal seasons. Sandy loam types of the Merrimac, Agawam and similar series are representative soils.

The organic content of the upper soil is reasonably favorable, ranging from 2.5 to 5 percent in most instances. It has not been depleted by the intensive cultivation to any serious degree. This is especially true of tobacco fields which are commonly protected by cover crop for several months of the year and which receive a significant contribution of organic matter in the form of cottonseed meal, castor pomace, fish meal and similar organic nitrogen carriers.

The native condition of acidity and moderately low available chemical fertility has usually been masked by the cumulative effect of past treatment. A moderately acid condition has been purposely established in order to prevent the black rootrot, *Thielavia basicola*, of the tobacco crop. Market garden fields have been limed to near the neutral point. Fertilizer applications have been very liberal for many years. Most soils no longer respond to special applications of phosphorus, and available potash is kept at a high level, sufficient to grow two or three additional crops without further potash application.

The occurrence of large level areas of easily tilled land, favorable for the production of a good yield of tobacco of fine quality for cigar wrapper and binder purposes, has resulted in the development of the Connecticut Valley tobacco industry. Adverse economic conditions in recent years have brought a considerable decrease in acreage devoted to this crop, but to a less degree than on land of other types less favorable for tobacco or more suitable for tobacco, vegetables or dairy feed crops.

Vegetables harvested in early summer do especially well, but midseason and late crops are apt to suffer from lack of moisture. The latter is also true of potatoes. Corn does well in years of normal rainfall, especially when planted after tobacco. Hay fields are short-lived. Alfalfa is the most suitable forage crop. The soils are poorly adapted to pasture, and dairying has rarely been developed to any considerable extent. Orcharding is not practiced on a commercial scale.

Areas of "K" land occurring outside the limits of the tobacco district are cultivated much less intensively as a consequence of their restricted range of crop adaptation. They are most commonly chosen for the production of early vegetables, but many fields are overgrown with broomsedge or pine.

K_t—Land of characteristics similar to "K" except that the sand and gravel deposits from which the soils are formed contain a predominance of material derived from the Triassic rocks of the Central Lowland or from the associated trap-rock formations. This sub-type is usually

gravelly to a considerable degree, especially in the lower horizons where rounded cobbles are common, particularly where there is a considerable amount of trap in the parent material. The sandy types of the Hartford and Chicopee series are representative soils.

Such land is not significantly different in adaptation or management from "K" areas elsewhere. However, a large proportion of the area lies outside the tobacco district, particularly in New Haven County, where it is used for vegetables to an important degree. Much of the surface is occupied by cities, towns and villages.

FIGURE 13. Broadleaf tobacco on Land Type K.

L—Level to gently undulating valley terrace land, of medium textured soils developed over strata of gravel and sand. Underdrainage is moderately rapid, but rarely excessive. Fine sandy loam and loam types of the Merrimac series and more level phases of the Hinckley series are representative soils. These occur most generally as narrow belts in the valleys of many streams throughout both Eastern and Western Highlands or along valleys entering the Central Lowland from them. The lower terraces of the Connecticut River, represented by the Agawam series, are also included.

The native organic content of the upper soil is favorable, ranging from 3 percent to 6 percent in most instances, and has rarely been depleted by cultivation. Organic matter maintenance requires similar measures to those found advisable for the "D" type.

The soil is naturally quite acid and low in chemical fertility. Residual fertility from past treatment is rarely as great as on the more intensively cultivated "K" areas, except in the Connecticut Valley where tobacco of especially fine quality is produced.

Such land, located in the highland valleys, provides the most arable fields of these regions and is used for a wide diversity of crops. However, it is especially suitable for vegetable crops of all sorts, as well as potatoes. Individual farm holdings are often too small to favor production on a commercial scale. Topographic location is usually unfavorable for orcharding. Both grass hay and pasture are less successful than on the heavier upland types. A very considerable percentage of such land is taken up by city, village and shore resort sites.

L_c—Land of above characteristics except as influenced to a degree by some limestone in the material composing the underlying sand and gravel deposits. The soils are naturally somewhat less acid and more fertile than other "L" soils, but are otherwise identical. The soils of the Palmyra series of the upper Housatonic Valley are representative.

L_t—Land of characteristics similar to "L" except that the sand and gravel deposits from which the soils are formed contain a predominance of material derived from the Triassic rocks of the Central Lowland or from the associated trap-rock formations. The fine sandy loam and

FIGURE 14. Vegetable Crops on Land Type L.

loam types of the Hartford and Chicopee series are representative soils. In the tobacco district they are much used for tobacco and potatoes. Elsewhere in the Central Lowland they have a wide range of adaptation for vegetable crops and are extensively used for this purpose, especially in New Haven County.

M_t—Level to undulating valley land of moderately heavy, imperfectly drained soils, occurring as broad swales between hill land of the "E_t" and "F_t" types. The underlying deposits are glacial till of heavy character derived from Triassic shales. The Whippany and Whitfield

series are representative soils. Small areas are found in many parts of the Central Lowland, but the most characteristic occurrences lie from West Hartford to West Suffield. Small sluggish streams may flow through the areas, but the soils are not characterized by an appreciable amount of alluvial sediment.

When kept clear and given some drainage, such land produces fair pasture. However, much of the surface is overgrown to brush and other inedible forage. Some of the more favorable fields are suitable for grass hay. Drainage outlets are difficult to provide; hence little reclamation of such wet land is practicable.

N—Bottom land of variable character, predominantly of light soils with poor drainage resulting from high water table during most of the year. Wide variations in texture and drainage conditions occur over small areas. The soils of the Podunk and Middlefield series are representative. The largest tracts of such alluvial soils are on the flood plains of the Connecticut and Farmington rivers. Other streams with considerable areas along their courses are the Pomperaug and Quinnebaug.

FIGURE 15. View across the Connecticut River meadows, Land Type N.

Narrow tracts are scattered along most of the large brooks and small rivers.

The better-drained alluvial soils, inundated only under exceptional conditions and represented by the Ondowa series, are grouped with the previously described "L" type. Most of the cultivated land of the Connecticut meadows is thus included.

The typical use of "N" areas is for grass hay, chiefly of the wild grasses adapted to such wet locations. The bottom land soils along the smaller streams are more extensively pastured and are often productive of much edible herbage. Occasional fields where the drainage is fairly good are often tilled, especially for late corn, but the crop is often spoiled by freshets. The wetness of the soil in early spring, and the frequency of floods at that season, limit the production of early-

planted crops. Many areas are definitely swampy and approach the characteristics of the "C" type.

O—Bottom land, of silty, deep alluvial deposits, usually deficient in drainage resulting from a high water table during most of the year. Soils of the Saco series and silt loam types of the Podunk and Middlefield series are representative. They occur in close association with the "N" types on the larger flood plains, particularly on areas most remote from the channels of the streams when in flood. They are especially common on the broad alluvial flats of the tributaries of the upper Housatonic River, in the towns of Canaan and North Canaan, and along the Scantic and similar streams of the Central Lowland where the gradient is especially slight.

Such land is not acid to any significant degree and has a higher productive capacity for grass hay and pasture than the "N" type. However, it is very difficult to drain, and is more often "boggy" in its character, making the use of hay-harvesting machinery impracticable and endangering grazing animals.

P—Muck land, artifically drained and suitable for cultivation. While many areas of potentially valuable muck lands occur in the State, they are usually too small in size, too inaccessible, or too remote from suitable drainage outlets to favor reclamation. In a few isolated instances, notably in the town of Branford just southeast of Lake Saltonstall, drainage has been successful, and a small but highly valuable tract of land suitable for celery, onions, cabbage and similar crops has been thus developed.

W—Waste land, resulting from gravel pits, quarry operations, etc. A large number of areas ranging up to several acres in size are to be found in many parts of the State, but are too small to be represented on the maps furnished with this bulletin except in one or two instances.

A SUMMARY OF CROP ADAPTATIONS

Numerous comments in regard to the suitability of the various land types for various crops have been made. Table 3 presents the degrees of adaptation to various crops, orchard, pasture and forest. It must be pointed out that these ratings are quite generalized, and many individual fields in an area represented as a given type may be unusually well or poorly suited to a given crop depending upon especially good or poor treatment in the past, or as a result of an unusual condition of stoniness, drainage, soil texture, surface relief, etc., which is not representative of the land of the locality. In the absence of a very detailed survey, these variations from average conditions cannot be recognized in a presentation of this sort.

A study of the distribution of present land use in agriculture and forestry is in progress and will be published at a later date. The various land types will be tabulated by towns.

TABLE 4. DEGREE OF ADAPTATION OF LAND TYPES TO VARIOUS CROPS, PASTURE AND FOREST

(5—Superior, 4—Favorable, 3—Fair, 2—Poor, 1—Not possible—)

Land Type	Tobacco*	Potatoes	Early Vegetables	Other Vegetables	Orchard Fruits	Alfalfa	Corn	Grass Hay	Pasture	Conifer Forest	Hardwood Forest
XX	1	1	1	1	1	1	1	1	1	3	4
X	1	1	1	1	1	1	2	2	3	4	4
X_k or X_c	1	1	1	1	1	1	2	2	4	3	5
X_t	1	1	1	1	3	1	2	2	3	4	4
X_j	1	1	1	1	2	1	2	2	3	4	3
A	1	1	1	1	3	2	2	3	4	3	5
A_k or A_c	1	1	1	1	3	2	2	3	4	3	5
A_t	1	1	1	1	3	2	2	3	3	3	5
B	3	1	1	1	1	2	2	1	1	4	2
C	1	1	1	1	1	1	1	2	2	1	4
C_s	1	1	1	1	1	1	1	3	1	1	1
D	1	2	4	3	3	4	3	3	3	4	4
D_k	1	2	4	3	3	4	3	3	3	3	5
D_t	2	3	4	3	3	4	3	3	3	4	4
E	2	3	3	3	4	4	4	4	4	4	5
E_k or E_c	2	3	3	3	4	5	4	4	5	4	5
E_t	3	4	3	4	5	4	4	4	4	4	5
F	1	3	2	3	3	3	5	5	5	3	5
F_c	2	2	3	3	3	3	5	5	5	3	5
F_t	2	3	3	3	4	3	5	5	4	3	5
G	1	4	3	3	3	4	5	5	5	3	5
G_c	2	3	3	3	3	5	5	5	5	3	5
G_t	4	4	4	4	4	4	5	4	4	3	5
G_e	4	5	4	4	3	4	4	3	2	4	4
H_t	3	3	3	4	2	3	4	4	3	3	5
I_t	1	2	1	2	1	2	4	5	4	2	5
J	1	3	3	3	2	3	3	2	2	5	3
J_c	1	2	2	2	2	4	3	2	2	4	3
J_t	2	3	3	3	3	4	3	2	2	5	4
K	5	3	5	3	2	4	3	2	2	5	3
K_t	4	4	4	4	2	4	3	2	2	5	3
L	5	5	4	5	2	4	4	3	3	4	4
L_c	3	3	4	4	2	5	4	3	3	4	4
L_t	4	4	4	4	2	4	4	3	3	4	4
M_t	1	1	1	2	1	1	2	5	4	2	4
N	2	2	1	3	1	2	3	4	4	2	3
O	1	1	1	1	1	1	2	5	5	2	4

*Applies to tobacco districts only.

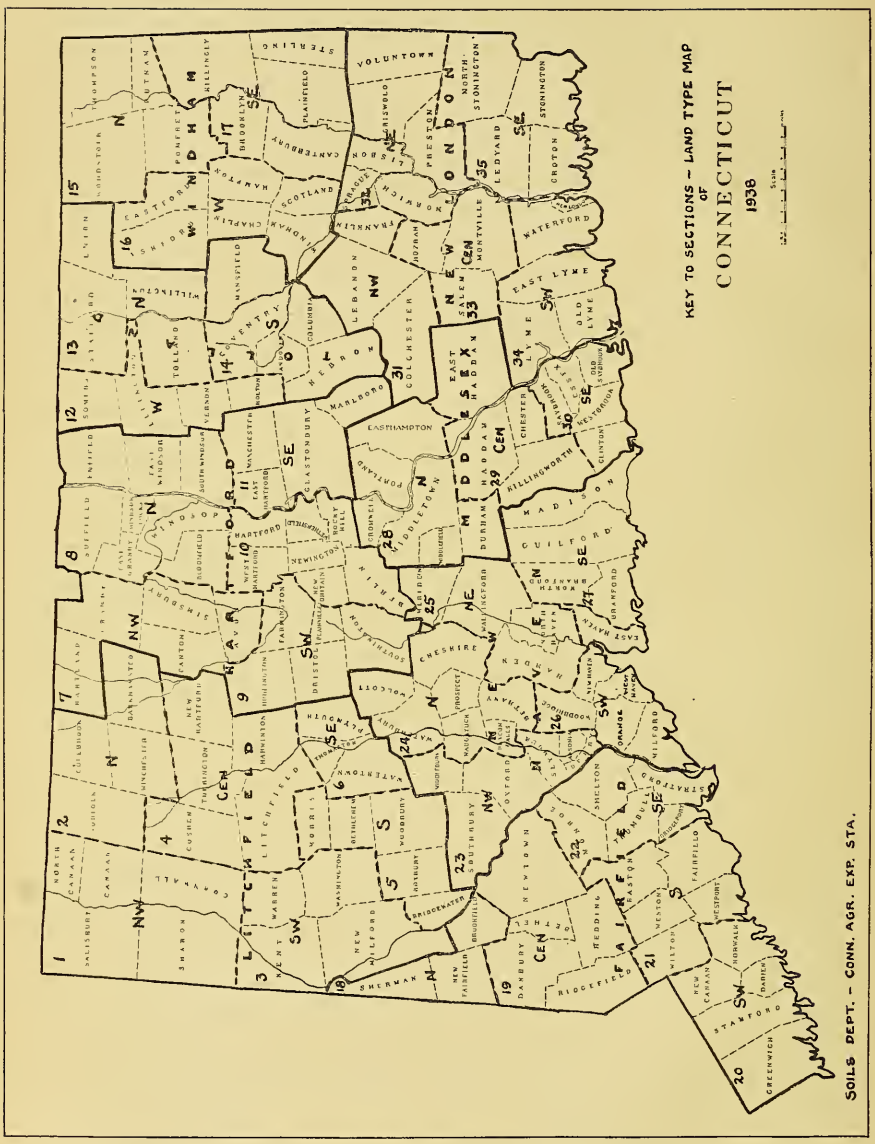


FIGURE 16. Grouping of towns for sectional land type maps, Nos. 1-35.

THE LAND TYPE MAPS

Recognizable areas of the various land types described in this bulletin are represented on the following outline maps, Numbers 1-35. For convenience, each county has been divided into from three to six groups of towns, and corresponding map numbers are as shown by Figure 16. The maps are printed on semi-transparent paper, at a scale of 1:250,000. This is the same scale as the folded road maps distributed free by the State Highway Department, Hartford. The land type maps show town boundaries, identifying place names and the more important trunkline and connecting highways. Any person wishing to locate the land types with respect to other roads, streams, small villages and other terrain features may readily do so by inserting a folded section of the highway map under the land type map so that the town boundaries coincide.

The maps show land types by letter symbols as heretofore described (pp. 43 to 60), and in most instances the representative soil series of each land type area is indicated by number.

Brief Key to Land Type Symbols

XX—Very stony or mountainous land
X—Stony, hillier land of light textured glacial till soils
A—Stony, hilly land of medium to heavy textured glacial till soils
B—Excessively sandy land, of level topography
C—Permanently wet muck and peat land
D—Hill land, of lighter textured, rapidly drained glacial till soils
E—Hill land, of light to medium textured, moderately drained glacial till soils
F—Hill land, of medium to heavy textured, slowly drained glacial till soils
G—Rolling land, of medium textured, perfectly drained till or outwash soils
H—Valley land, of light textured, moderately drained soils over stratified clay
I—Valley land, of heavy textured, slowly drained soils over stratified clay
J—Valley land, irregular surface, of gravelly and sandy soils over sand or gravel
K—Valley land, level surface, of moderately sandy soils over sand or gravel
L—Valley land, level surface, of medium textured soils over sand or gravel
M—Valley land, of medium to heavy textured soils, imperfectly drained, over till
N—Bottom land, of lighter textured, imperfectly drained alluvial soils
O—Bottom land, of medium to heavy textured, imperfectly drained alluvial soils
P—Muck land, artificially drained for cultivation

Subscript to symbols

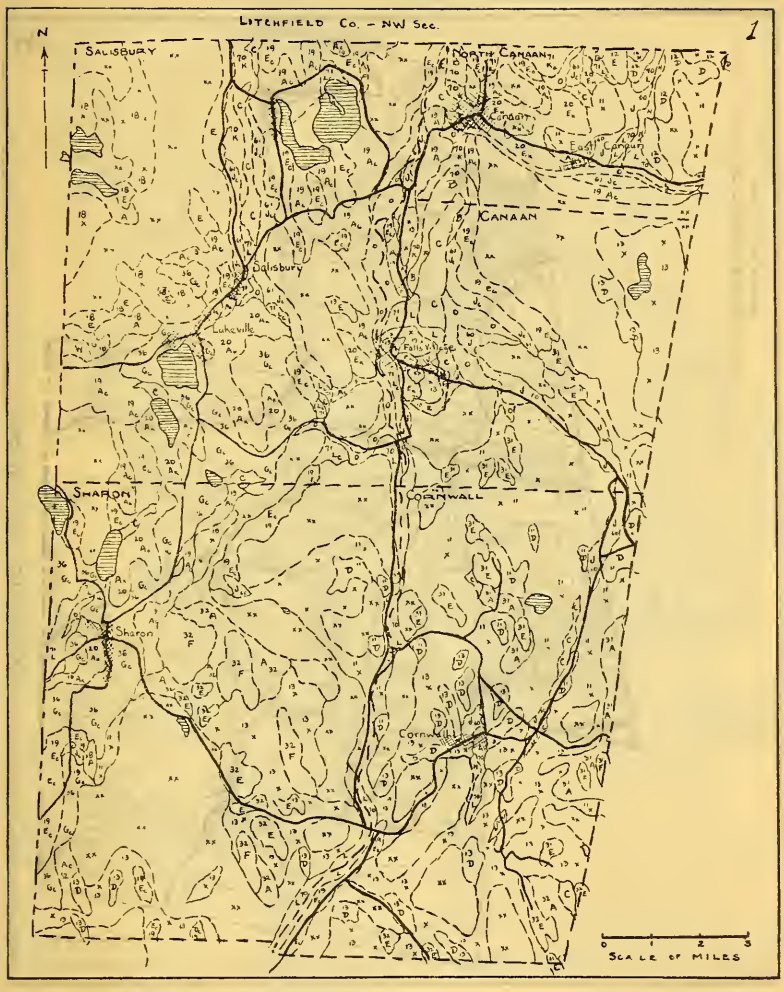
no subscript—derived from non-calcareous crystalline material (gneiss, schists, granite, quartzite, etc.) or undifferentiated
sub-$_c$ —derived in part from calcareous material
sub-$_k$ —derived chiefly from calcareous material
sub-$_t$ —derived from Triassic sandstone, shale or trap
sub-$_j$ —underlain with coarsely stratified gravel and sand
sub-$_e$ —material in the soil horizons of aeolian deposition
sub-$_s$ —impregnated with salt from tidal action

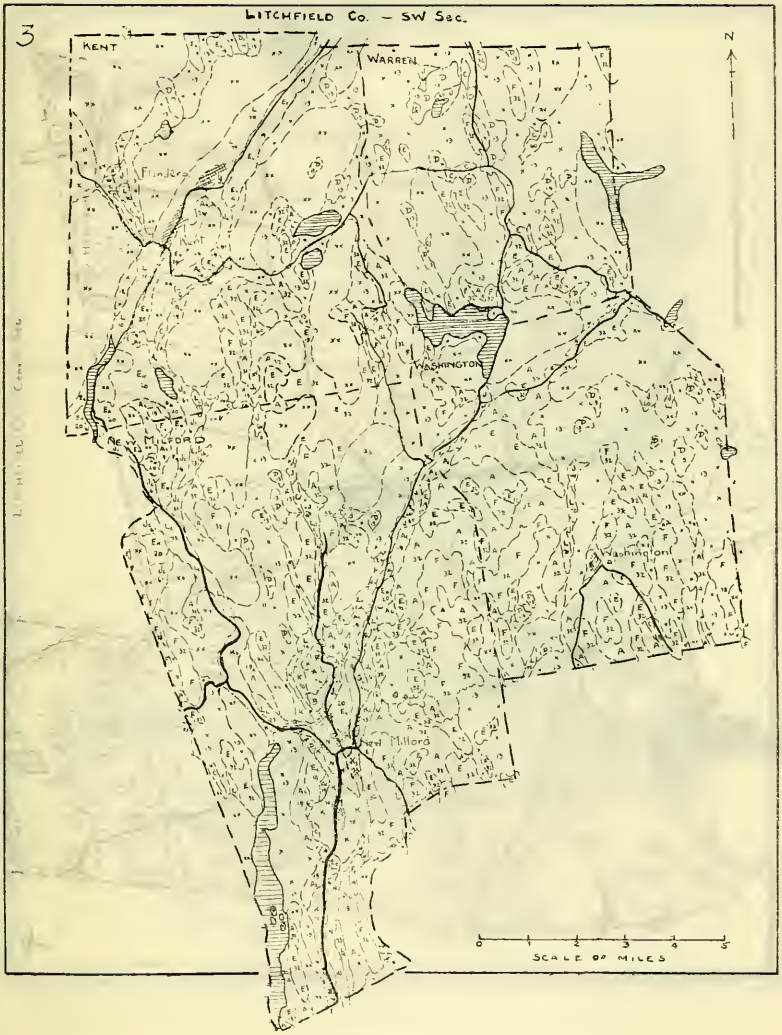
NUMBER DESIGNATING SOIL SERIES

The following numbers designating soil series have been in use by the Soils Department of this Station for several years; not all are represented in sufficient area to be indicated on the land type maps:

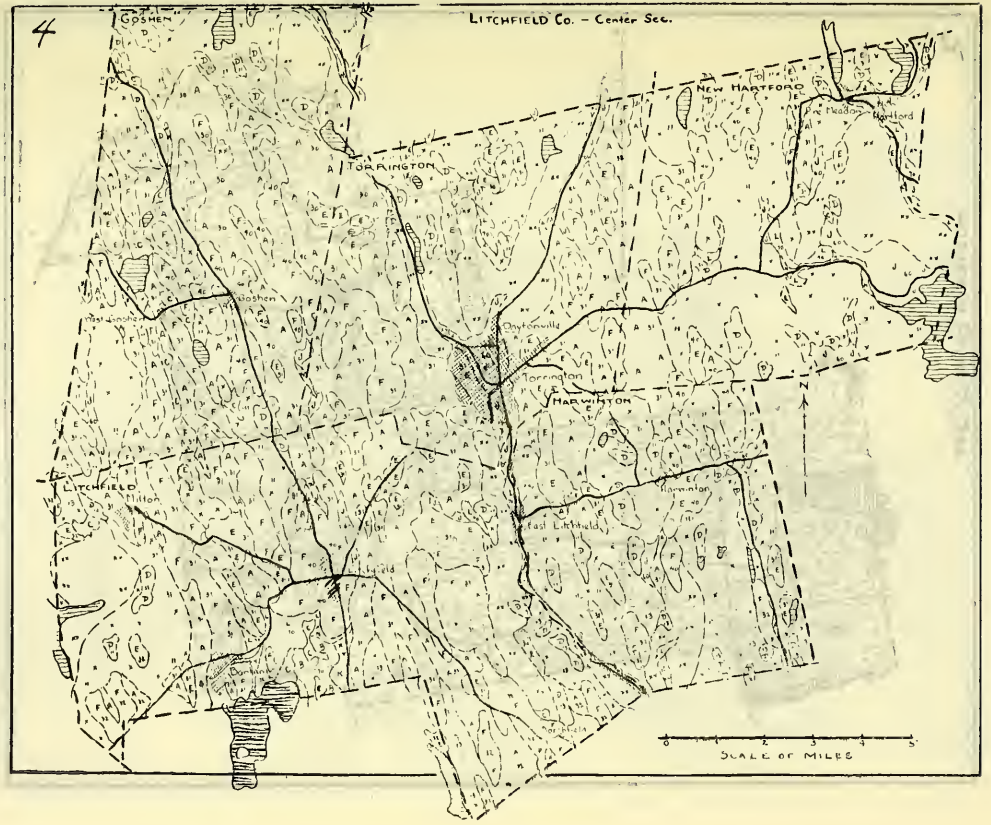
9—Hermon
10—Plymouth
11—Gloucester
12—Coloma
13—Brookfield
14—Hinsdale
15—Wilton
16—Maltby
17—Hollis
18—Dutchess
19—Pittsfield
20—Dover
21—Holyoke
22—Essex
23—Middletown
30—Becket
31—Woodbridge
32—Charlton
33—Haddam
34—Bernardston
35—Paxton
36—Lenox
37—Cheshire
38—Wethersfield
39—Taugwank
40—Litchfield
41—Sutton
42—Stockbridge
43—Peru
44—Whippany
50—Whitman
51—Lyons
52—Whitfield
59—Hampden
60—Hinckley
61—Rodman
62—Manchester
63—Hancock
65—Enfield
66—Melrose
67—Windsor
68—Chicopee
69—Agawam
70—Merrimac
71—Sheffield
72—Fairlea
73—Palmyra
74—Hartford
75—Scarboro
76—Ellington
77—Suffield
78—Berlin
79—Scantic
80—Ondowa
81—Podunk
82—Saco
83—Middlefield
91—Shallow muck
92—Muck
93—Peat
94—Tidal marsh
95—Rough stony land
96—Rock outcrop
97—Coastal beach
98—Made land
99—Gravel bank

The above soils are described on pages 21 to 39.

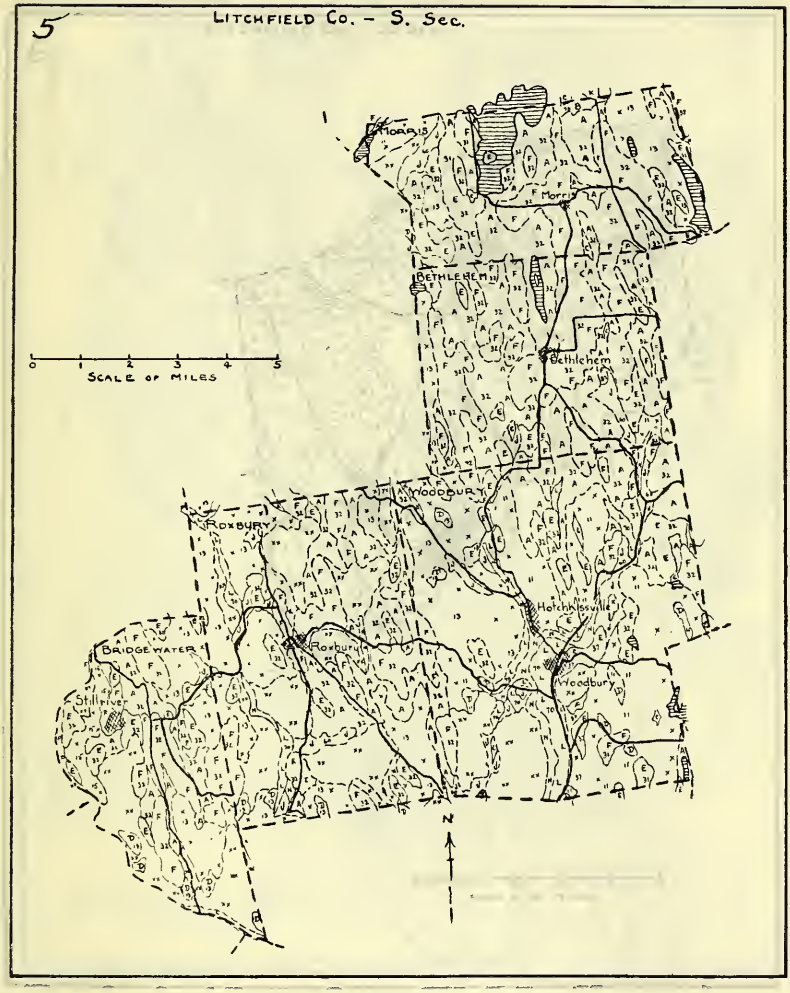

LITCHFIELD Co. - NW Sec.
1
N
SALISBURY
NORTH CANAAN
CANAAN
Salisbury
Lakeville
Falls Village
SHARON
CORNWALL
Sharon
Cornwall
0 1 2 3
SCALE OF MILES


3
LITCHFIELD Co. — SW Sec.
KENT
WARREN
N
WASHINGTON
MILFORD
Washington
Milford
SCALE OF MILES

KENT
WASHINGTON
SCALE OF MILES


4
LITCHFIELD Co. – Center Sec.
GOSHEN
TORRINGTON
NEW HARTFORD
Hartford
Goshen
Torrington
HARWINTON
LITCHFIELD
Litchfield
East Litchfield
Harwinton
Bantam
SCALE OF MILES
0
1
2
3
4
5

SCALE OF MILES
FAIRFIELD CO. - CONN.
WESTPORT
NORWALK
DANBURY
BETHEL
REDDING
RIDGEFIELD
WILTON
NEW CANAAN

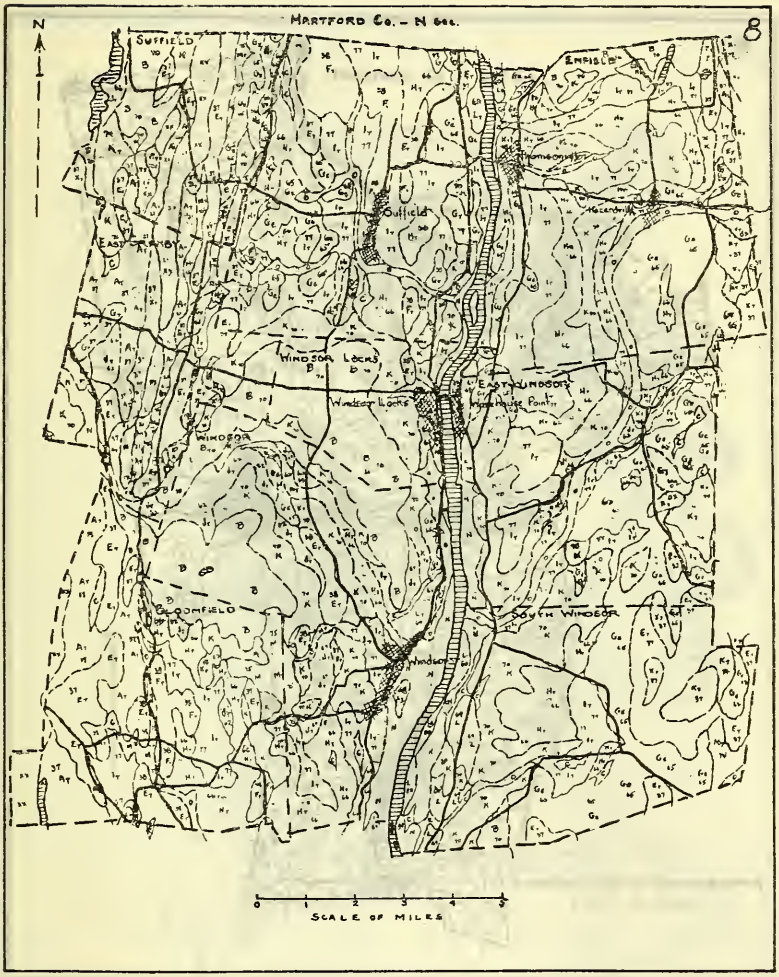

5
LITCHFIELD CO. - S. SEC.
Morris
Bethlehem
Woodbury
Roxbury
Bridgewater
Roxbury
Woodbury
Hotchkissville
Woodbury
Stillriver
0 1 2 3 4 5
SCALE OF MILES
N

LITCHFIELD CO. - S. SEC.
SCALE OF MILES
0
1
2
3
4
5
N

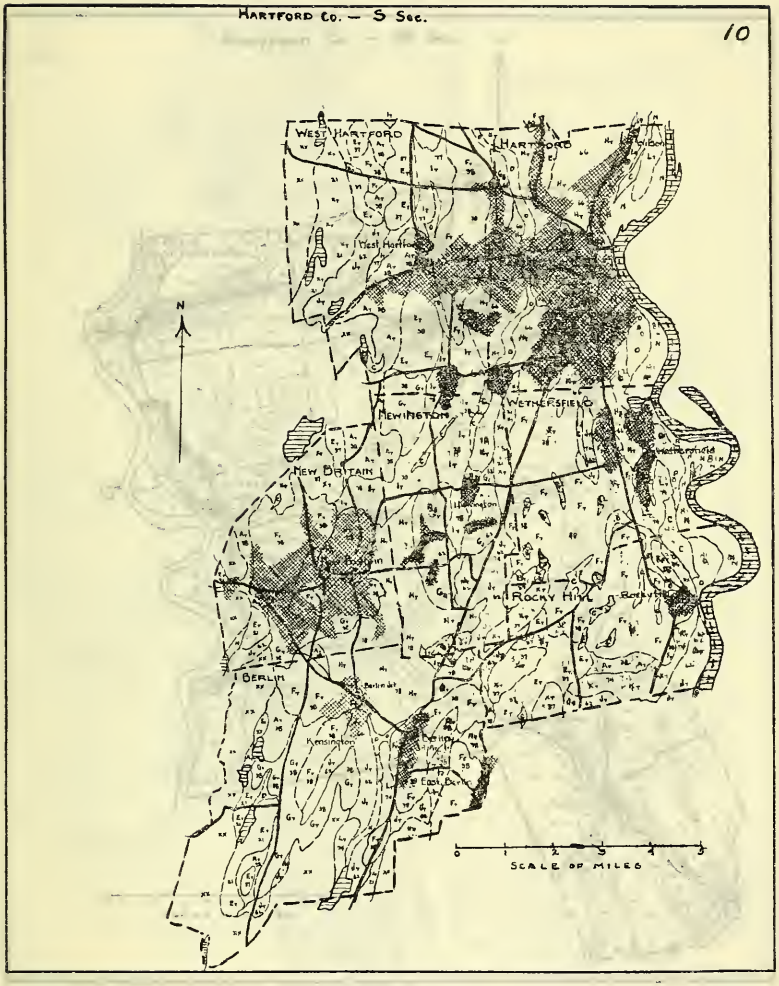
6

LITCHFIELD CO. - SE Sec.

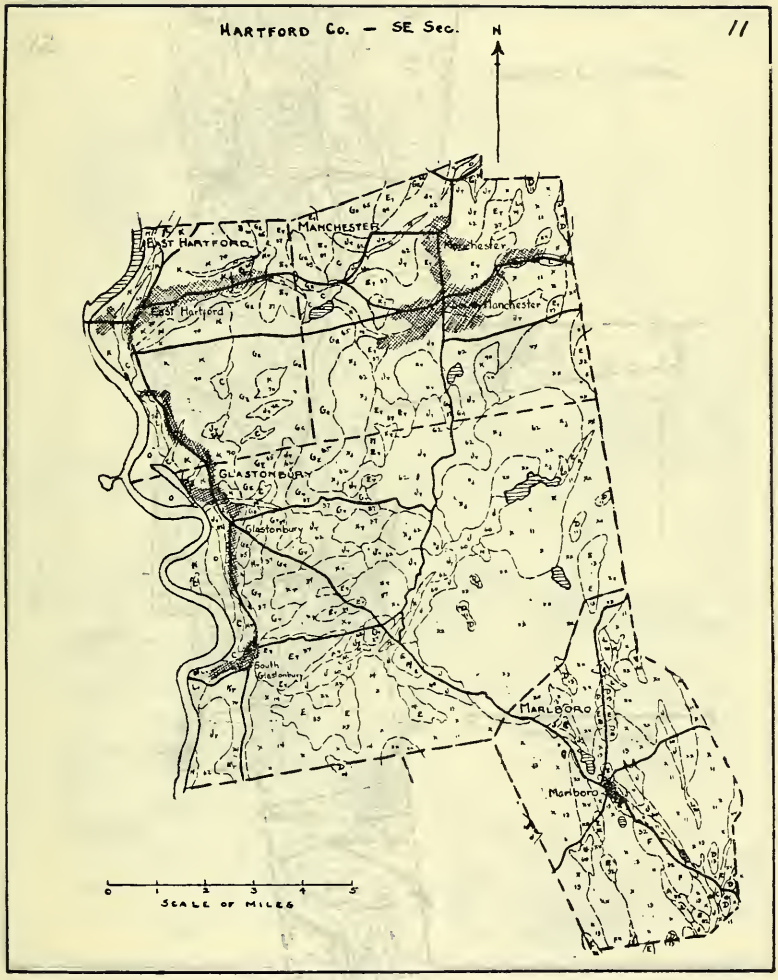
HARTFORD CO. - NW Sec.
HARTLAND
Granby
Canton
Simsbury
Avon
Scale of Miles
0
1
2
3
4
5
N


HARTFORD Co. – N 6ee.
8
N
SUFFIELD
ENFIELD
Thompsonville
Suffield
Hazardville
EAST GRANBY
WINDSOR LOCKS
Windsor Locks
EAST WINDSOR
Wapping
WINDSOR
BLOOMFIELD
SOUTH WINDSOR
Windsor
0 1 1/2 3 4 5
SCALE OF MILES

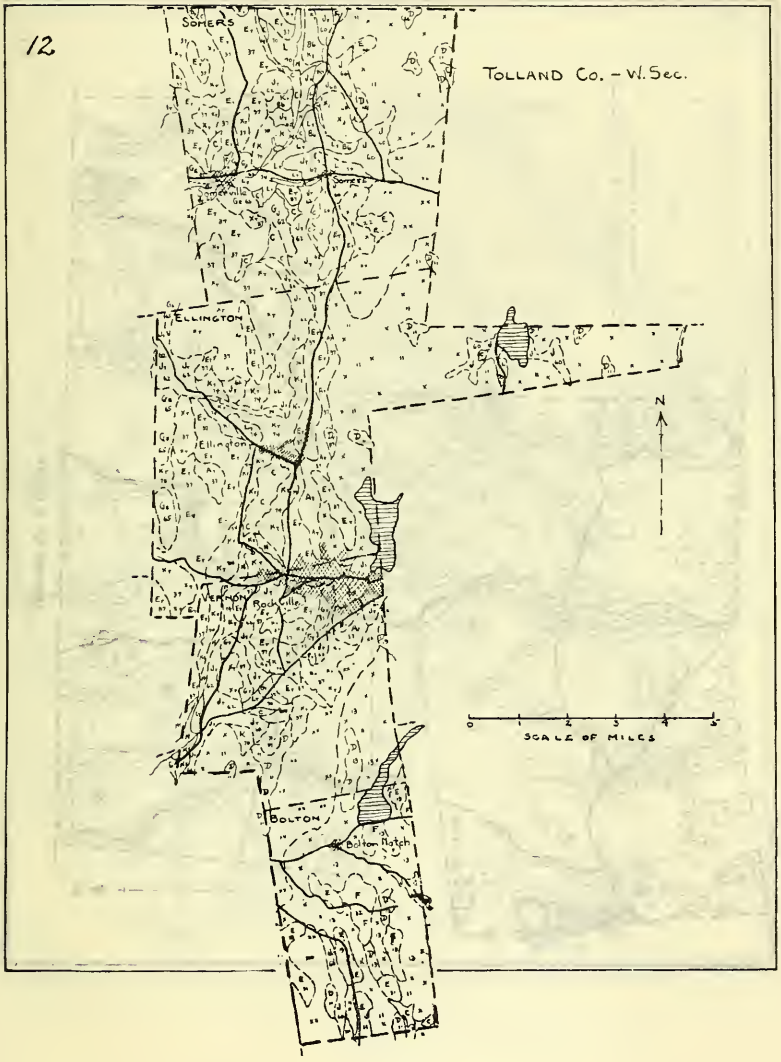
HARTFORD Co. – SW Sec.
SCALE OF MILES


HARTFORD Co. — S Sec.
10
WEST HARTFORD
HARTFORD
NEWINGTON
WETHERSFIELD
NEW BRITAIN
ROCKY HILL
BERLIN
N
0 1 2 3 4 5
SCALE OF MILES

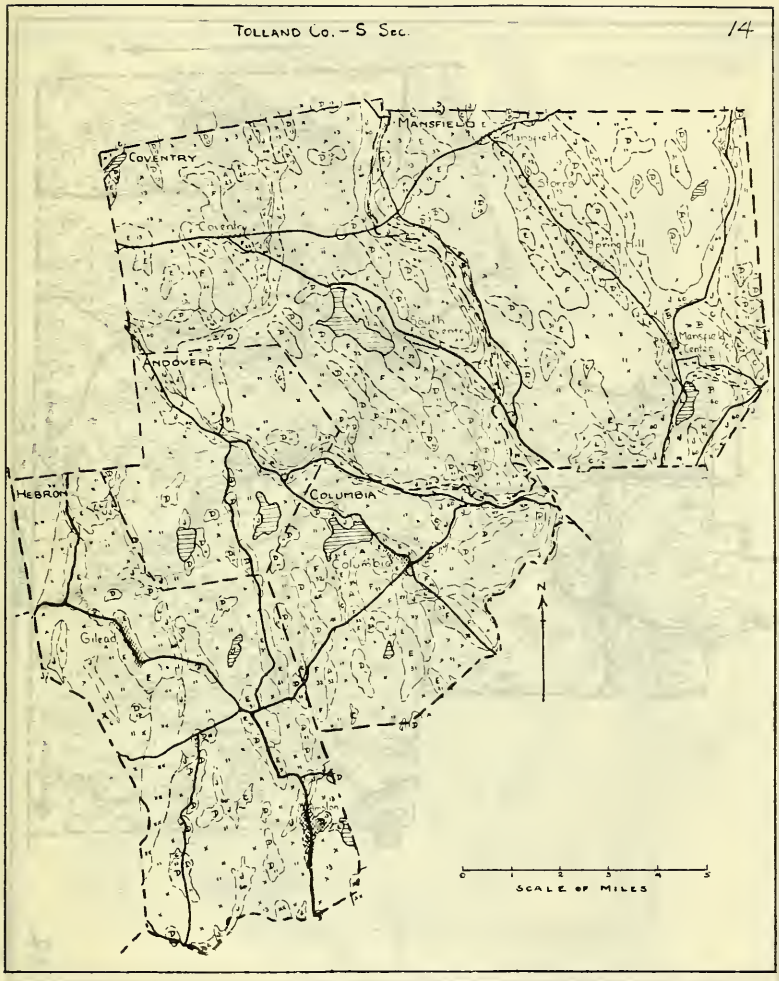
HARTFORD CO. — S Sec.
WEST HARTFORD
HARTFORD
West Hartford
WAYNE TERRIO
HEMINGTON
NEW BRITAIN
ROCKY HILL
BERLIN
N
SCALE OF MILES
0
1
2
3


HARTFORD Co. — SE Sec.
N
11
MANCHESTER
EAST HARTFORD
East Hartford
Manchester
GLASTONBURY
Glastonbury
South Glastonbury
MARLBORO
Marlboro
0 1 2 3 4 5
SCALE OF MILES

HARTFORD Co. — SE Sec.
N
SCALE OF MILES
0
1
2
3
4
5
EAST HARTFORD
GLASTONBURY
MANCHESTER
Manchester
Glastonbury
East Hartford
Hartford
Rocky Hill
Wethersfield
Newington
Berlin
Farmington
Bristol
New Britain
Plainville
Southington
Meriden
Middletown
Portland
Cromwell
Rocky Hill
Wethersfield
Newington
Berlin
Farmington
Bristol
New Britain
Plainville
Southington
Meriden
Middletown
Portland
Cromwell

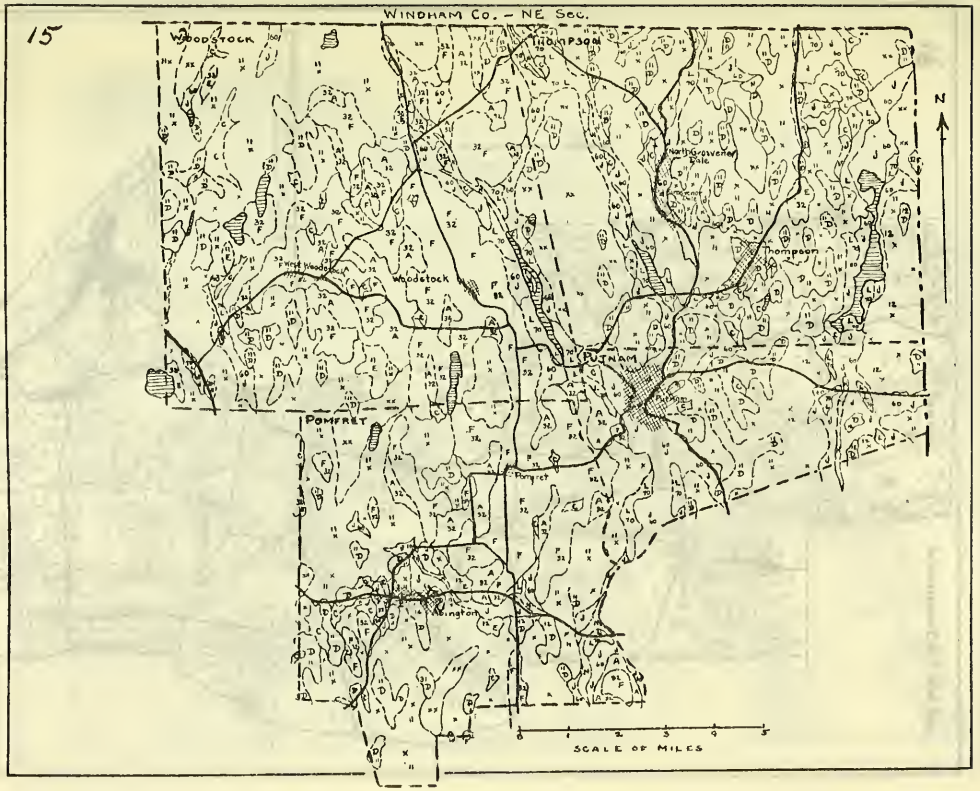

12
TOLLAND CO. - VI. SEC.
SOMERS
ELLINGTON
VERNON
Rockville
BOLTON
Bolton Notch
N
0 1 2 3 4 5
SCALE OF MILES

Scale of Miles
0
1
2
3
Colorado
Larimer Co. - N 256

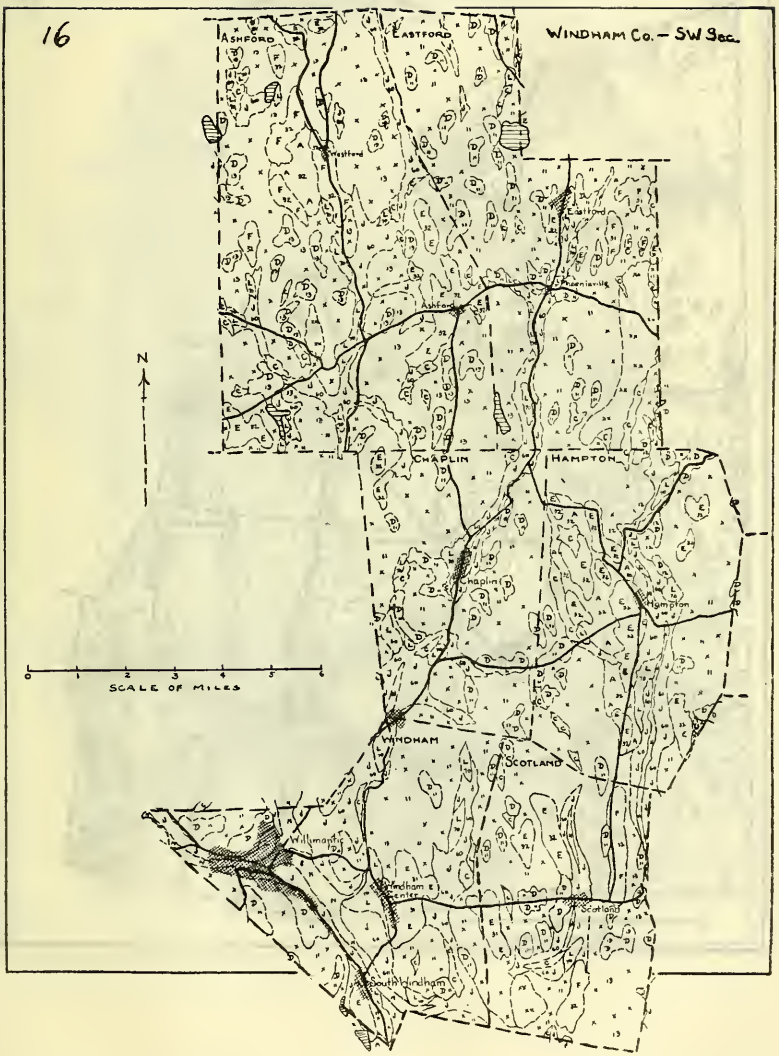

TOLLAND CO. – S SEC.
MANSFIELD
COVENTRY
ANDOVER
HEBRON
COLUMBIA
GILEAD
N
0 1 2 3 4 5
SCALE OF MILES

Tolland Co. - 5 Sec
Mansfield
Coventry
Hebron
Columbia
Scale of Miles

15

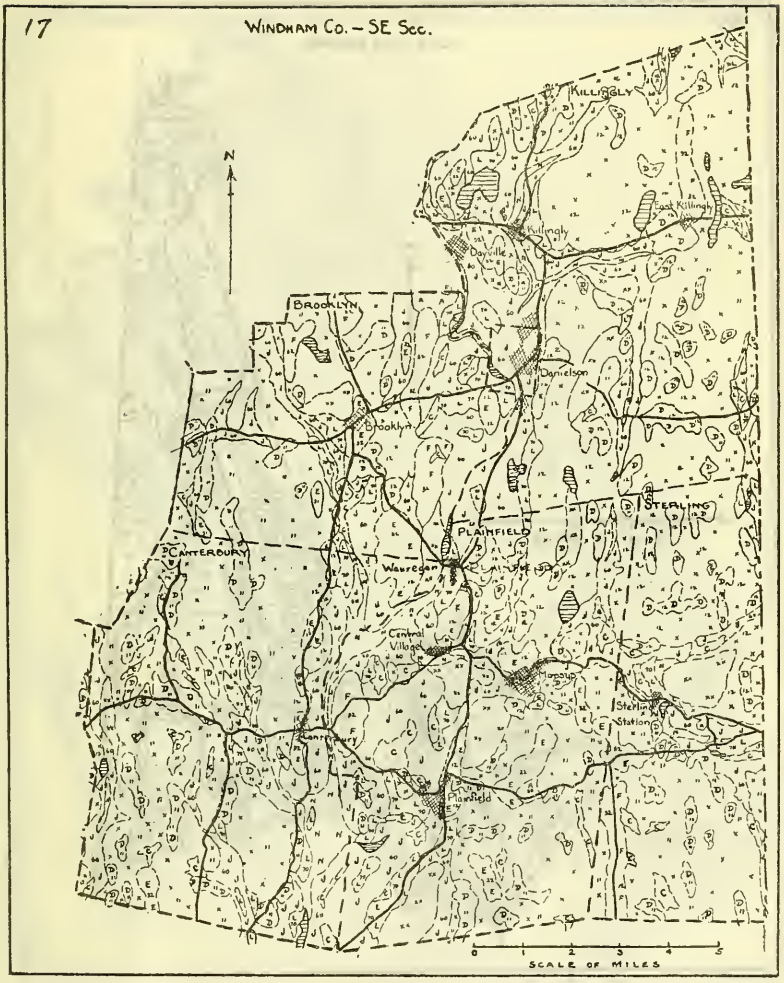

WINDHAM Co. – NE Sec.
WOODSTOCK
THOMPSON
POMFRET
PUTNAM
Woodstock
Thompson
Pomfret
Putnam
N
SCALE OF MILES

N
SCALE OF MILES
0
1
2
3
MINIDOKA CO. - IDAHO
ROCKLOCK
DONNELL
MINIDOKA
ROCKLOCK

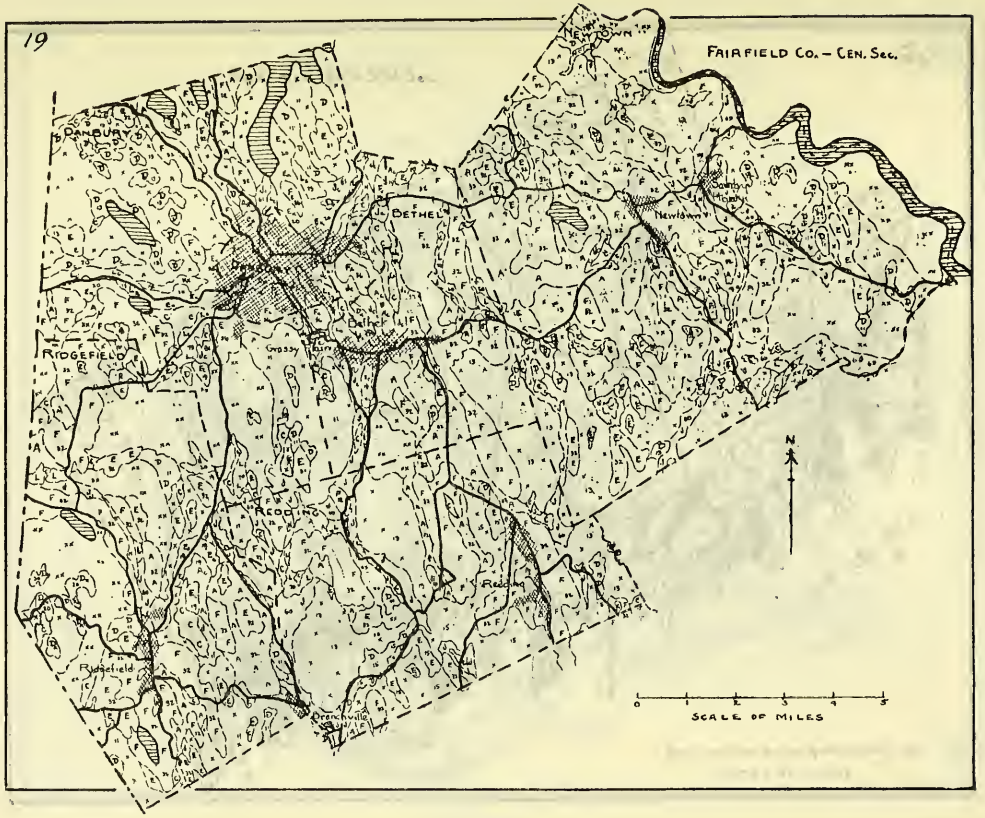

16
WINDHAM Co. – SW Sec.
ASHFORD
EASTFORD
Eastford
Ashford
Pomfret
CHAPLIN
HAMPTON
Chaplin
Hampton
WINDHAM
SCOTLAND
Willimantic
Windham Center
Scotland
South Windham
N
SCALE OF MILES
0 1 2 3 4 5

16
WINDHAM CO. — SW SEC.
ASHFORD
CHAPLIN
HAMPTON
SCOTLAND
WINDHAM
N
SCALE OF MILES
0
1
2
3

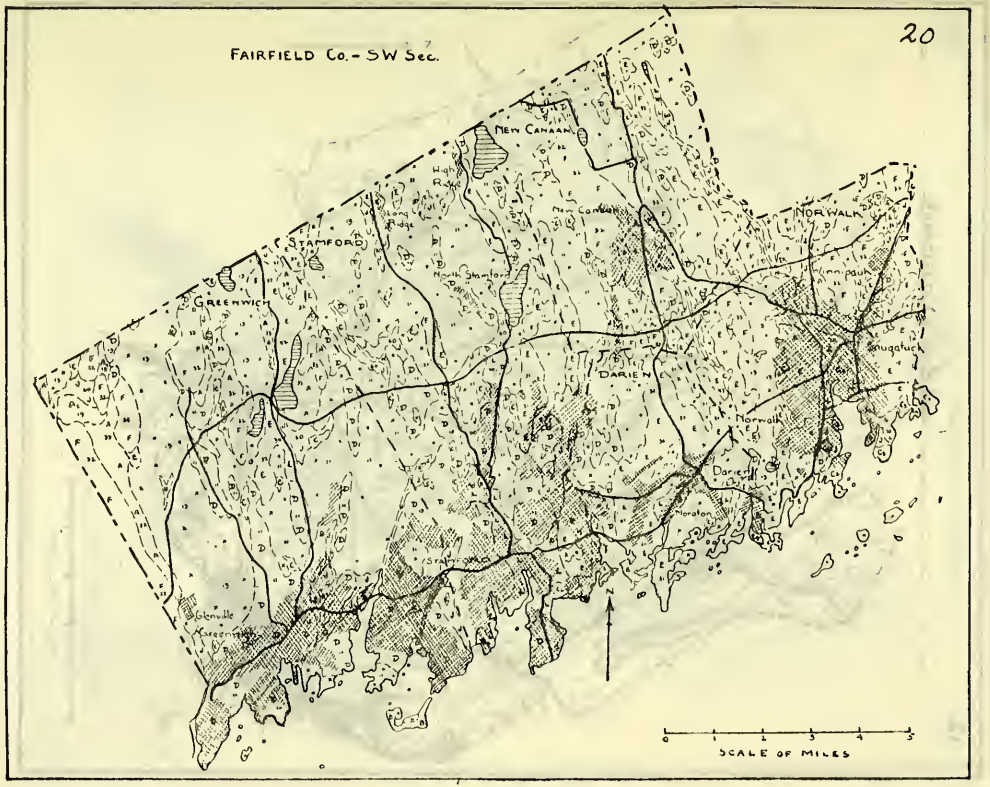
17


WINDHAM CO. – SE Scc.
N
KILLINGLY
East Killingly
Killingly
Danielson
BROOKLYN
Brooklyn
STERLING
PLAINFIELD
CANTERBURY
Wauregan
Central Village
Sterling
Sterling Station
Lawfield
0 1 2 3 4 5
SCALE OF MILES

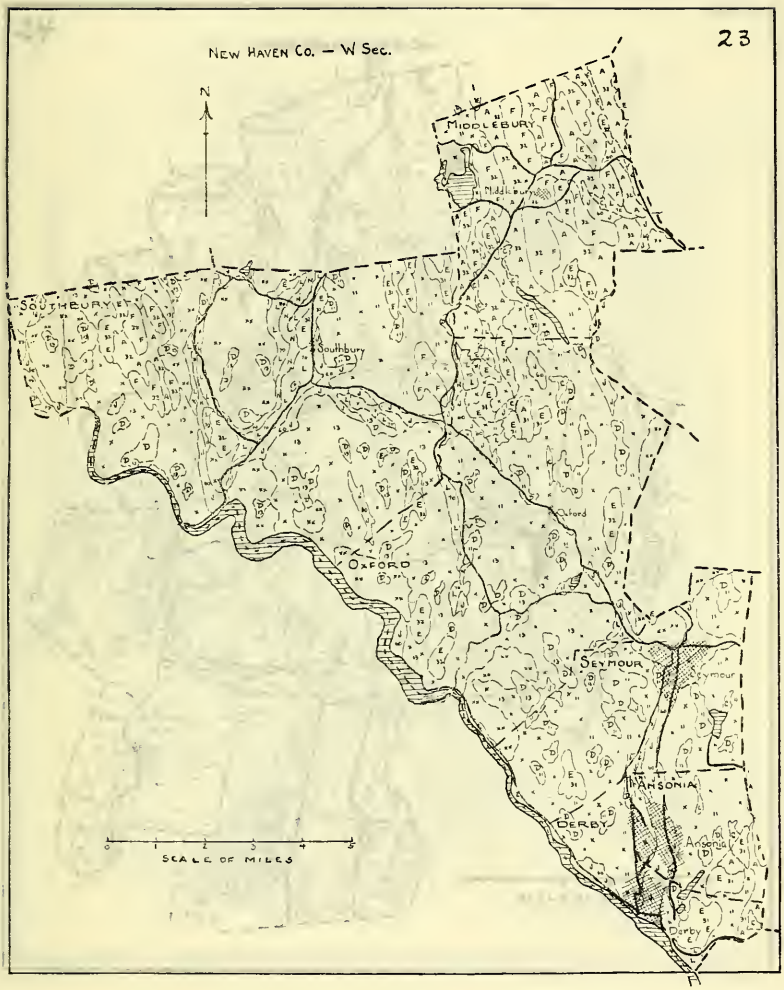
Fairfield Co. - N 306
N
SCALE OF MILES
0
1
2
3
4
SHERMAN
FAIRFIELD
BROOKFIELD


FAIRFIELD CO. – CEN. SEC.
DANBURY
BETHEL
Newtown
RIDGEFIELD
Gaylordsville
REDDING
Redding
Ridgefield
Georgetown
N
0 1 2 3 4 5
SCALE OF MILES

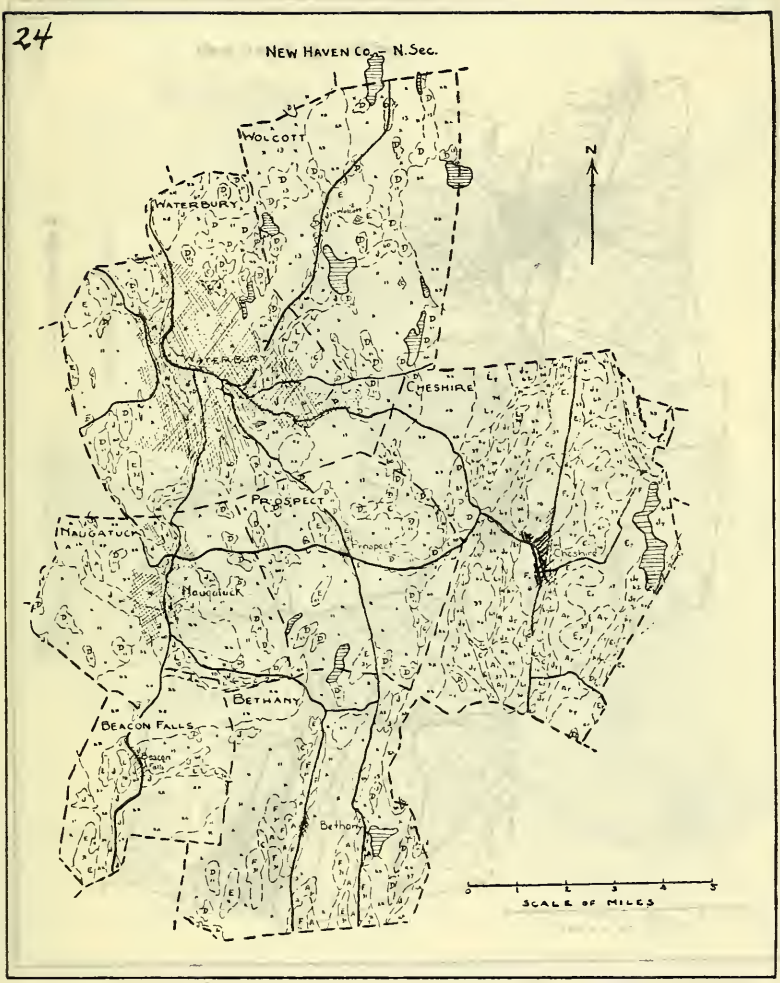
FAIRFIELD CO. - CEM 2ed
SCALE OF MILES
0
1
2
3
4
N
GREENE
WESTPORT
NORWALK
STAMFORD
DARIEN
NEW CANAAN
WILTON
NEWTOWN
BETHEL
DANBURY
BROOKFIELD
RIDGEFIELD
WESTON
REDDING
SHERMAN
NEW FAIRFIELD
BRIDGEPORT
TRUMBULL
EASTON
FAIRFIELD
WESTPORT
WILTON
NORWALK
STAMFORD
DARIEN
NEW CANAAN
BETHEL
DANBURY
BROOKFIELD
RIDGEFIELD
WESTON
REDDING
SHERMAN
NEW FAIRFIELD
BRIDGEPORT
TRUMBULL
EASTON
FAIRFIELD


FAIRFIELD Co. - SW Sec.
NEW CANAAN
STAMFORD
GREENWICH
NORWALK
DARIEN
Norwalk
Darien
Glenville
N
0 1 2 3 4 5
SCALE OF MILES

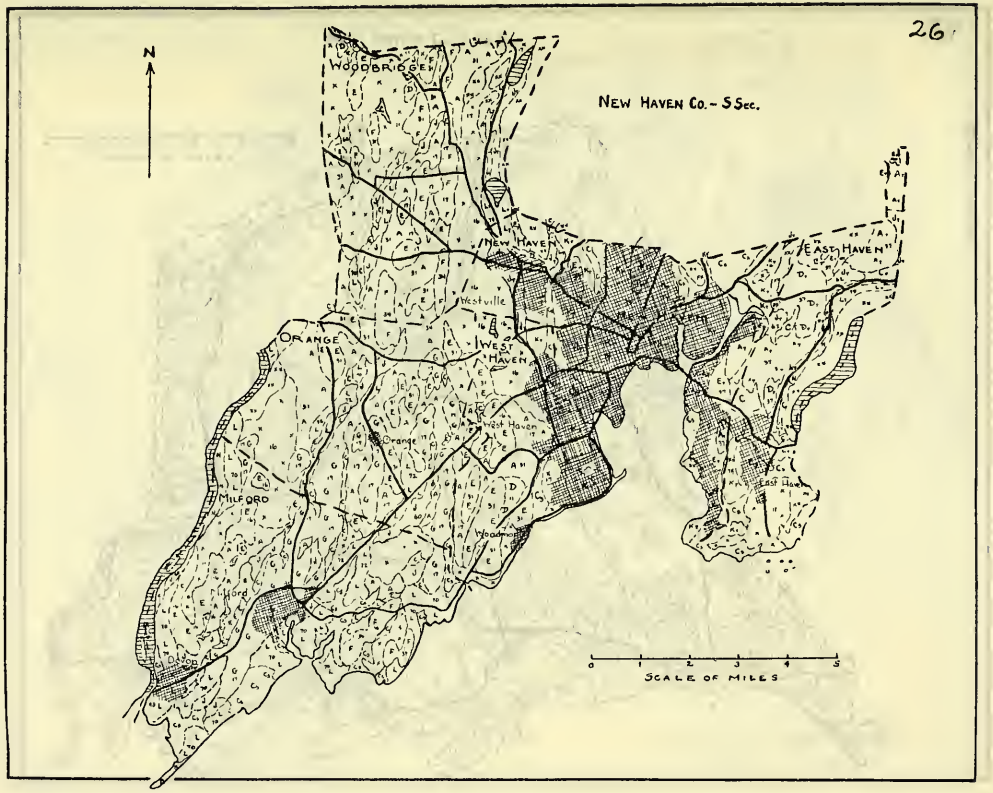
22
FAIRFIELD Co. - SE Sec
SHELTON
HUNTINGTON
TRUMBULL
STRATFORD
BRIDGEPORT
N
SCALE OF MILES
0
1
2
3
4
5


23
NEW HAVEN CO. — W SEC.
N
MIDDLEBURY
SOUTHBURY
Southbury
Oxford
OXFORD
SEYMOUR
Seymour
ANSONIA
Ansonia
DERBY
Derby
0 1 2 3 4 5
SCALE OF MILES

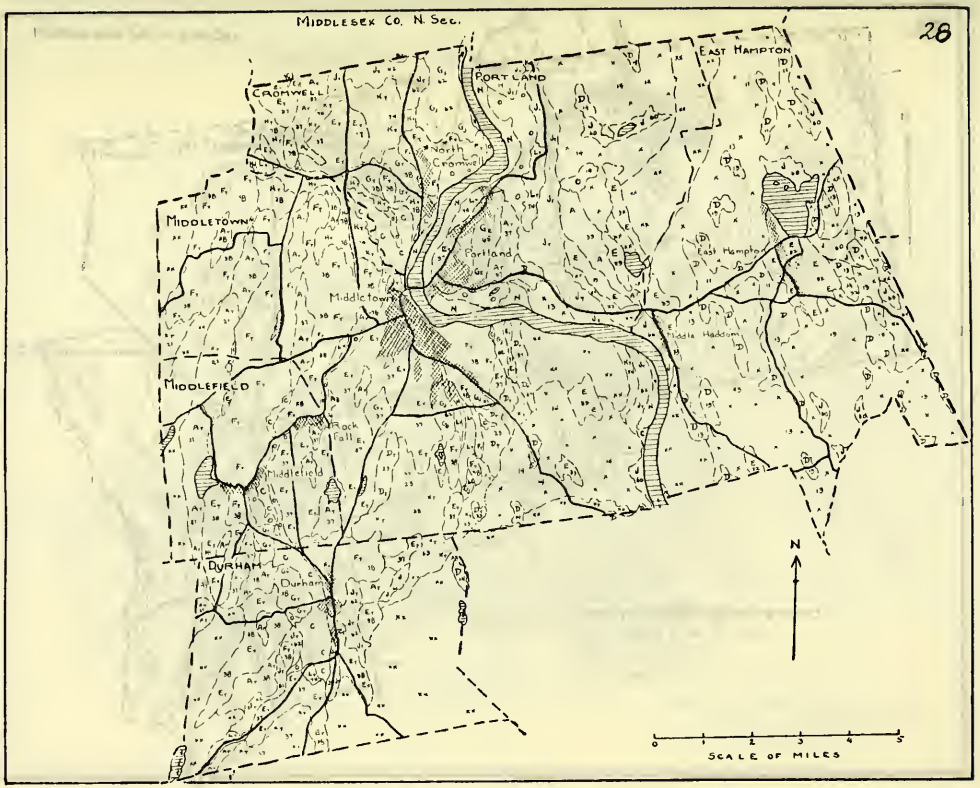
NEW HAVEN CO. — W SEC.
N
WOODBURY
SOUTHBURY
OXFORD
DERBY
SCALE OF MILES


NEW HAVEN Co. N. Sec.
WOLCOTT
WATERBURY
CHESHIRE
PROSPECT
NAUGATUCK
BETHANY
BEACON FALLS
N
SCALE OF MILES

MERIDEN
WALLINGFORD
NORTH HAVEN
HAMDEN
N


N
NEW HAVEN CO. - S SEC.
WOODBRIDGE
NEW HAVEN
EAST HAVEN
Westville
ORANGE
WEST HAVEN
West Haven
Orange
East Haven
MILFORD
Woodmont
Milford
0 1 2 3 4 5
SCALE OF MILES

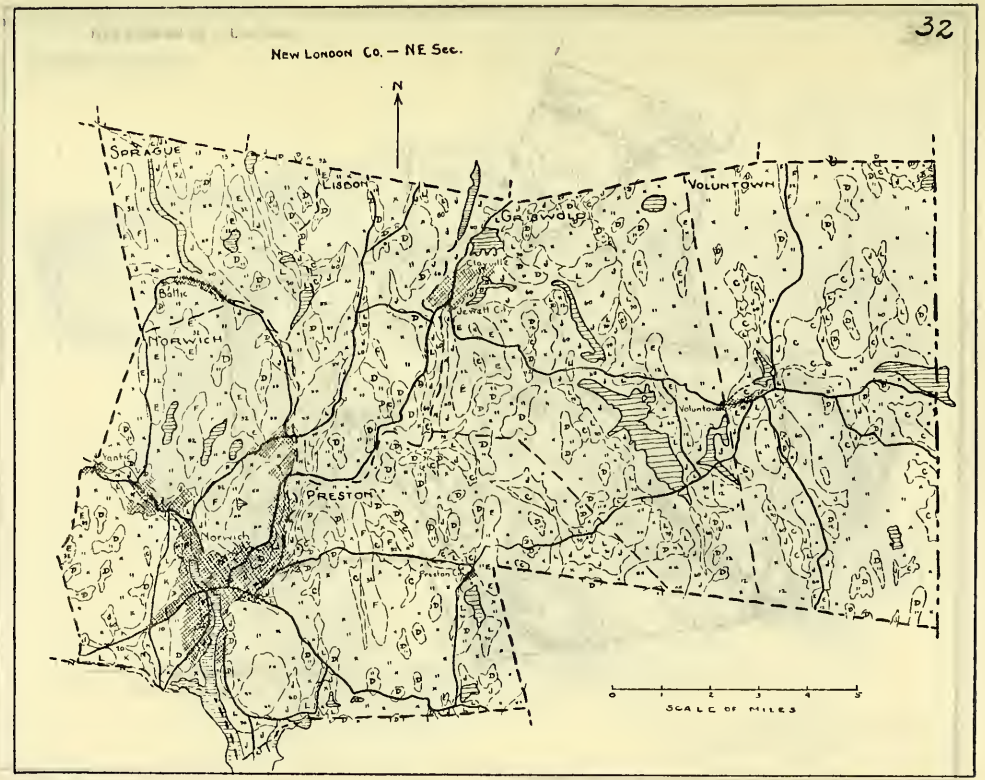
Scale of Miles
Derby
Orange
Milford
Woodbridge
Bethany
Hamden
Cheshire
Wallingford
Meriden
Middletown
Durham
Guilford
Madison
New Haven
Branford
North Haven
Wallingford
Cheshire
Hamden
Bethany
Woodbridge
Orange
Derby
Milford
New Haven Co. – 27 Sep.
N


MIDDLESEX CO. N. SEC.
28
CROMWELL
PORTLAND
EAST HAMPTON
MIDDLETOWN
MIDDLEFIELD
DURHAM
North Cromwell
Portland
Middletown
East Hampton
Middle Haddam
Rock Fall
Middlefield
Durham
N
0 1 2 3 4 5
SCALE OF MILES

MIDDLESEX CO. — DEM. 2007
SCALE 2 0 1 2 3 MILES
N
ANDOVER
TEWKSBURY
METHUEN
LAWRENCE

MIDDLESEX CO. — SE. SEC.

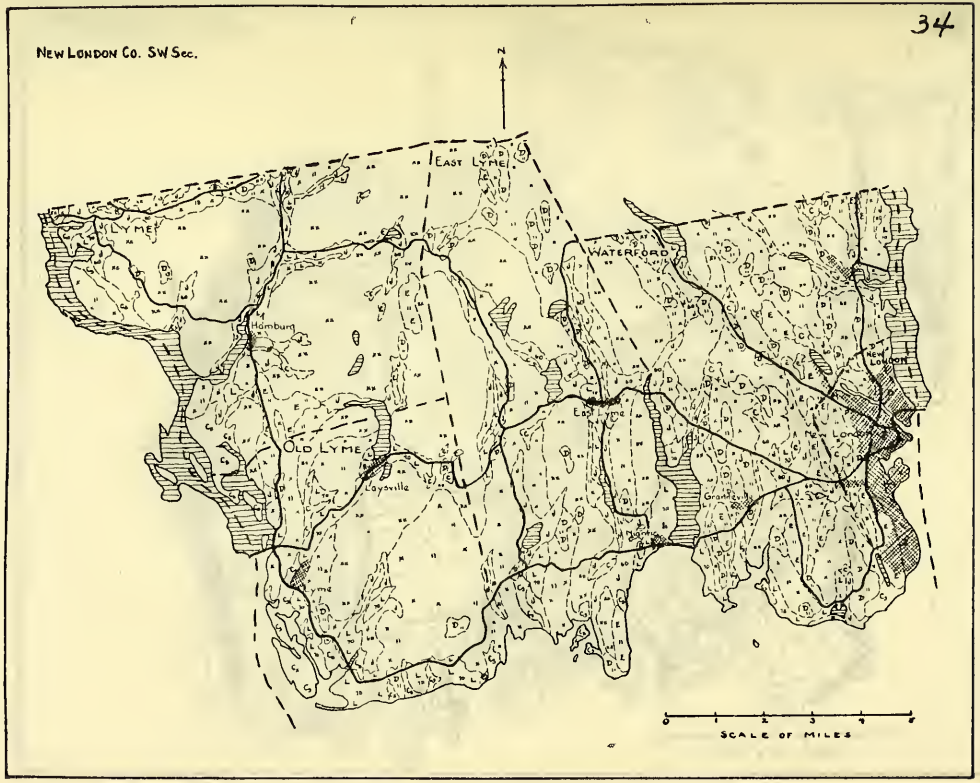
NEW LONDON CO. - NW SEC.
N
SCALE OF MILES
0
1
2
3
4
5
Ordovician
Cambrian
Precambrian
Triassic
Intrusive


New London Co. — NE Sec.
N
SPRAGUE
LISBON
GRISWOLD
VOLUNTOWN
Baltic
NORWICH
PRESTON
SCALE OF MILES

NEW LONDON CO — NE SEC.
SCALE OF MILES
0
1
2
N
MONTVILLE
NORWICH
GRISWOLD
LISBON
PRESTON
LEDYARD

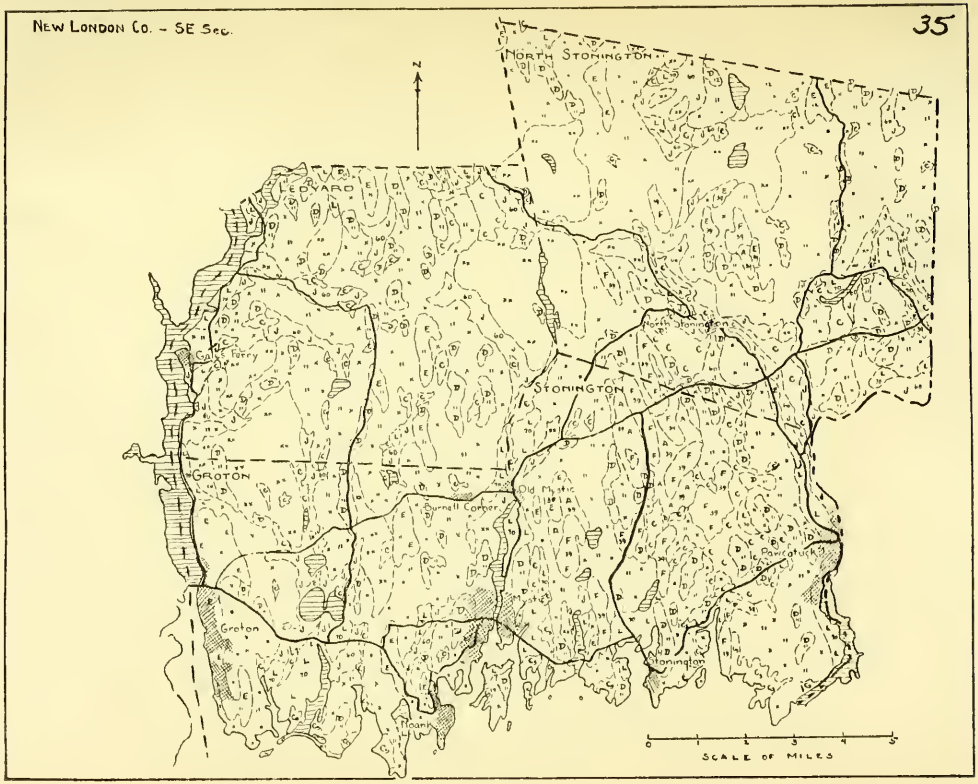
NEW LONDON CO. – Cen. Sec.

New London Co. - Geo. Surv.
Madison


NEW LONDON CO. SW SEC.
N
EAST LYME
LYME
WATERFORD
Hamburg
OLD LYME
Lymeville
Niantic
Oswegatchie
SCALE OF MILES

Newland Co. Wyo.
Scale of miles
0
1
2
3
4
N
Laramie Peak
Platte R.
Douglas
Glenrock
Casper
Natrona Co.
Converse Co.
Laramie Co.
Goshen Co.
Platte Co.

43


NEW LONDON CO. - SE SEC.
N
NORTH STONINGTON
LEDYARD
Gales Ferry
STONINGTON
North Stonington
GROTON
Burnett Corner
Old Mystic
Pawcatuck
Groton
Mystic
Stonington
SCALE OF MILES
0
1
2
3
4
5

32
View London 10 Sec Sec

5000 04

University of
Connecticut
Libraries

39153028977751